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Australia and America

In no other country will American men serving overseas find a population with characteristics so much like our own as in Australia. That is the conclusion of a statistical study made by the Metropolitan Life Insurance Company which gives a parallel between Australian and American health conditions. Australia has long had an enviable and well-deserved reputation for its good health conditions. In pre-war times only New Zealand had mortality and longevity records more favorable.

American death rates have always been somewhat higher than those of Australia, although in recent years the two series have approached each other. Since the beginning of the century, the crude death rate in Australia fell from 12.2 per 1,000 in 1901 to a minimum of 8.6 in 1930, after which it rose to 9.9 in 1939. This rise in the rate is a consequence of the aging of the population. American death rates began the century on a materially higher level, 16.5 per 1,000 in 1901, but descended almost continuously to an all-time low of 10.6 in 1939. The recent mortality figures for white persons in the United States are particularly close to those of Australia for certain age groups, e.g., under twenty-five years and over sixty-five.

Since the death rate from all causes is somewhat more favorable in Australia than here, the more important causes of deaths, such as diseases of the heart, cancer, accidents, and diabetes, follow suit. Australia is famous for its brilliant record of low infant mortality. As matters now stand, the mortality of white infants in our country is still about twenty-five percent higher than that in Australia, but it is rapidly declining to a similar low level (38 per 1,000 live births in Australia against 48 per 1,000 live births in America). There are a few more important causes of death in which we, by a small margin, better the record of Australia, the chief of these being tuberculosis, influenza and pneumonia.

The study of the Metropolitan Life Insurance Company gives some more figures of interest. Although the area occupied by Australia is only just a little under that of the United States, its population is somewhat less than seven million. The American population of one hundred and thirty-three million is about nineteen times that number. Not all of the Australian continent is habitable, about one third of it being practically desert land. The country is highly urbanized. In fact, almost half the people live in its six largest cities, and about two thirds live in urban areas.

One fifth of Australia's breadwinners are in normal times engaged in agriculture, forestry and mining. More than one quarter of its occupied workers are ordinarily engaged in industrial activities, such as manufacturing, building, and road construction.

The sex and age composition of the Australian population is curiously like ours. Our birth rates also are not far apart, and their trends are similar. The Australian marriage rates, on the other hand, are somewhat lower than ours, which, as a matter of fact, are among the highest in the world.

The Giant Magnet and Foreign Bodies in the Eye

Ophthalmic injuries in wartime are numerous and require skillful and careful treatment. The removal of a magnetic foreign body from the eye, compared with that of some other foreign bodies, is comparatively simple. In a clinical lecture given at Guy's Hospital, London, in 1940, Frank W. Law discussed methods of treating eye injuries, and referred especially to the removal of steel foreign bodies from the eye.

The object of the procedure with the giant magnet is to get the foreign body into such a position in the eye that it can be removed without unnecessary trauma. Suppose a large foreign body went in towards the periphery of the cornea, crashed its way through the ciliary body, broke up part of the suspensory ligament of the lens, and came to rest in the vitreous, leaving a gaping wound. Such a foreign body can almost certainly be removed by putting the patient in front of the magnet, switching it on, and then dragging out the foreign body. However, when this has been done one may also drag out with it other things not unimportant to vision, as the vitreous, the ciliary body and even the lens.

It is sometimes inevitable that if there is a retained foreign body in the posterior segment one has to remove it by perforation of the sclera, and, of course, the choroid and retina, not pleasant structures into

which to plunge one's knife, with all the possibilities of hemorrhage, detachment, and so on. Dr. Laws has never seen the lens injured by dragging the foreign body to the position where one wants it, when this is done skillfully. The large magnet, therefore, is used to drag the foreign body forward. It finds its way by rather mysterious means around the ciliary body, through the fibers of the suspensory ligament into the posterior chamber. One sees it bulging the iris, and at this point, one is usually told by the patient, sometimes in very emphatic language, that something is happening. The foreign body is drawn through the pupil and then a surgical operation is begun. The giant magnet has done its part, an essential part of the work.

It will be understood that skill and care are necessary in order to use the large magnet to the best advantage. The object is not only to get out the foreign body from the eye, but in doing this to cause the least possible injury to those accessories of vision which are in any way associated with the faculty of sight. To do this successfully calls for ophthalmic knowledge, skill and meticulous care. A false move and much harm may be done.

Flying Doctors

Between five and six hundred flying doctors are being commissioned every month in the United States Army's newest and fast growing medical service. All of the doctors who enter the Medical Air Corps are designated either as aviation medical examiners or flight surgeons. To help meet the requirements, the Army School of Aviation Medicine at Randolph Field, Texas, has been conducting courses to qualify physicians as medical examiners. In normal peacetime these courses lasted four months, now they last three months. The course consists of instruction in ophthalmology, in the physiological effects of flying conditions, and in the study of neuropsychiatry, the latter being of special importance because the flight surgeon must be prepared to anticipate changes in the mental attitude of pilots, to eliminate fatigue in flight crews, and to free the minds of his men from worry. He participates also in "familiarization flights" so that he may know the conditions the men in his charge will face.

Upon completion of training, the doctor becomes an aviation medical examiner and is assigned either to a flight squadron or to an air field for seasoning for a year. After a year of satisfactory service as examiner, he may qualify as flight surgeon, when his duties will be both administrative and functional. He is responsible for the care of the sick in hospitals and the routine physical care of the flying personnel. If stationed at an air field, he also consults with the commanding officer on problems of sanitation. If assigned to a tactical unit, he selects medical equipment and is responsible for its maintenance. In actual combat, he gives first-aid to wounded men returning from bombing, observation or flight missions, and supervises all hospitalization.

The Army School of Aviation Medicine was born in 1918, when the Army Central Medical Research Laboratory began functioning at Mineola, Long Island. The school has been moved several times, but since October 1931 it has been located at Randolph Field, Texas. The Navy established a School of Aviation Medicine about two years ago at Pensacola, Fla.

New research shows that fighting and bombing will probably go no higher than forty thousand feet—unless new gadgets are perfected. Both body and brain become weary and slow down above thirty-five thousand to forty thousand feet. The greatest hazard for altitude airmen is their conviction that they are perfectly all right when a reduced oxygen supply actually causes impairment of coordination and reaction time which may render them dangerous to their own and the whole crew's safety.

According to a report in the *Journal of the Aeronautical Sciences,* forty-four thousand feet, with oxygen masks, is probably the absolute upper limit for flying. In a low pressure chamber which reproduced conditions at that altitude, subjects passed the limit of effective activity, and were in a precarious state. The problem of keeping warm high up is less critical. Temperatures of almost—70° Fahrenheit are encountered at extreme altitudes, but electrically heated suits have proved fairly satisfactory.

Treatment of Cancer of the Colon

It is a truism that if carcinoma were diagnosed more promptly many lives might be saved and in some cases the disease might be cured, as Mr. Cecil P. G. Wakeley says in an article on the subject contributed to *Modern Treatment Year Book,* 1941. It is a discredit to the medical profession that the common forms of cancer, such as carcinoma of the breast, the tongue, and the rectum, are frequently overlooked until the condition is inoperable. Education of the public on this important subject would be worth more than any amount of clinical research in late cases.

Mr. Wakeley is insistent that surgical treatment is the sole satisfactory method for dealing with malignant disease of the colon. All other methods of treatment are unsatisfactory and cannot be said to bring about a cure of the disease. Again, as is pointed out by Mr. Wakeley, early operation in carcinoma of the colon gives excellent results. The operative mortality is small and the majority of patients live well beyond the five year period. There is no doubt that many cases of early cancer of the bowel would be discovered if the public would submit to periodic medical examinations. To diminish the death toll of cancer there should be early diagnosis and prompt surgical intervention.

Papers and Addresses

THE TREATMENT OF BRONCHIAL ASTHMA WITH PERTUSSIS VACCINE*

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It requires a great deal of courage for a general practitioner to come before a medical gathering and speak on such a complicated subject as bronchial asthma. Although the asthmatic syndrome has been known for centuries, we still lack a clear understanding of the mechanism behind the asthmatic attack.

The turning point in our conception of bronchial asthma came when Richet discovered the phenomenon of anaphylaxis. Some years later Meltzer called attention to the similarity between the bronchospasm as seen in the guinea pig dying from anaphylactic shock and the bronchospasm in the human during an asthmatic attack. Today, it is generally accepted that bronchial asthma is an allergic disease, a term introduced by Von Pirquet and Schick to describe an altered reaction in some of their patients treated with antitoxic serum.

The allergic theory assumes that the human individual at some time has become sensitized to some substance, variously termed as allergen, atopen, or antigen, and that a subsequent exposure to the same substance will produce in the allergically predisposed individual clinical manifestations in the sensitized organs. If these organs happen to be the bronchi an asthmatic attack may result. If the sensitization took place in the skin, urticaria or other skin efflorescences may appear. You see how greatly one might be tempted to identify allergy with anaphylaxis.

Indeed, the question is still open. The main difference is that anaphylaxis was born in the experimental laboratory and observed in animals where the time of sensitization was well known, while allergy, a term applied to man, is a clinical manifestation; the time of sensitization can usually not be fixed, and also the portal of entry is unknown.

Those who oppose this conception argue that it is difficult to sensitize man experimentally and that generalized shock such as that seen in the guinea pig cannot be produced in the human. For this reason many investigators are of the opinion that allergy is an inherited constitutional disease.

Pathology

Two cardinal components form the basis of the asthmatic syndrome:

A. The exudative phase, where an increased secretion of mucus into the bronchioli takes place.

B. The spastic phase, where the smooth musculature of the bronchial mucosa goes into a spastic contraction.

I believe in the theory advanced by Curschmann that the hypersecretion is the primary cause of asthma, and I regard the spasm as only secondary, and rather a defensive mechanism to prevent a complete obstruction of the bronchial lumen by mucus. (It is not unlike the reflex spasm of the glottis when a foreign body tries to enter the larynx.) In "abortive" asthma, where exudation is not excessive, the spastic phase does not appear.

Etiology and Classification

In the etiology of bronchial asthma anything and everything can be blamed. Even a drink of cold water may usher in an asthmatic attack.

Rackemann divides asthma into two large groups: A, intrinsic or hereditary asthma; and B, extrinsic, or bacterial asthma.

Since, as a practitioner, I have to rely for the most part on bedside observation, I prefer a clinical classification based on the severity and frequency of the attacks. I divide my asthmatics into four groups:

A. Severe asthma, including status asthmaticus.

B. Active asthma—patients suffering from relatively frequent attacks requiring adrenalin for relief.

C. "Abortive" asthma—patients in whom the asthmatic attacks are limited to dyspnea and wheezing, without the spastic phase.

D. Latent asthma—Patients with a positive history of asthmatic attacks, but who are free of symptoms for long periods of time.

In view of our present knowledge of asthma this classification seems to me as practical as any for the time being.

Therapy

The allergic conception of bronchial asthma led to new forms of therapy: the elimination and desensitization treatments. If we are to be guided by textbooks it would seem child's play to treat asthma today. All we have to do is to perform a number of skin tests, find those giving a positive reaction, and tell the patient to avoid that particular allergen, or, if this is not feasible, to desensitize the patient with a number of injections containing the offending allergen. This procedure seems simple and is theoretically sound. However, the classic example of the asthmatic who was sensitive to glue and was cured of his asthma as soon as he stopped licking Uncle Sam's postage stamps still remains a will-of-the-wisp.

In bronchial asthma everything from adrenalin, the most potent drug, down the alphabet to the vitamins has been tried and advocated, sometimes with success, more often with complete failure. The most frequently used drugs are either of the sedative group, such as opium, phenobarbital and their derivatives, or drugs which exert their action on the autonomic nervous system, such as adrenalin, ephedrine, and the alkaloids of the atropine group. Next come the supportive drugs,

*Read before the East Side Clinical Society, New York.

the iodides, the xanthine group, especially aminophyllin—and finally, anything which can be made into a pill. Surgery, fever therapy, even psychoanalysis have been tried, and each has successes as well as disappointments to register. The desensitization treatment, being the logical outgrowth of our revised conception of asthma, is in the foreground. And after we have failed with a "rational" form of treatment, we return meekly to the "hit or miss" method. To this rich variety I am advocating the addition of a new type, the pertussis vaccine treatment.

I became interested in asthma only lately, and against my will. It forced itself upon me when I was called to attend a patient for an asthmatic attack. This particular patient, a woman in her forties, was suffering at that time from severe bronchial asthma with hourly attacks requiring large doses of adrenalin for fleeting relief. I tried to send her to a hospital, but she insisted on "dying" in her own bed. It was only natural that upon reanalyzing the symptoms of asthma, the analogy with whooping cough should force itself upon me.

Anatomically pertussis attacks the same organs as asthma; the spastic episode is common to both diseases; and so is the character of the sputum. In no other disease could I recall such a tenacious and viscid sputum as seen in pertussis and asthma. Further, there is the common tendency of the attacks to appear at night, and last but not least, the similarity between the finale of asthma and pertussis. With the expectoration of a plug of mucus the storm is over.

This similarity of symptoms was too tempting for a man not deeply rooted in allergy. On my next visit I injected the patient with the pertussis vaccine (in addition to five cc. of her own blood, since autohemotherapy has been used with some success). The result of this unorthodox treatment was remarkable. Within forty-eight hours all attacks ceased. However, "one robin does not bring the spring". It might have been pure coincidence. Perhaps the attacks would have subsided anyway; maybe the large amount of adrenalin accumulated in the body was responsible for the sudden cessation of the attacks. The only test of this treatment was to duplicate these results in another and equally severe case of asthma.

I had on my record a twelve year old girl suffering from bronchial asthma whom I had referred to a hospital for treatment about a year previously. She had been in a University Hospital for some weeks and after a complete "work up" was discharged with a syringe and a bottle of adrenalin to shift for herself. I found her now in a much worse condition than before, with attacks coming every hour or even more frequently. With the consent of her parents I repeated the treatment exactly as in the first case—with the same results. Within two days all attacks ceased.

In a short time I was able to try this treatment in four other patients with similar results. A preliminary report of this work was published in the MEDICAL RECORD (1). This marked the first phase of my experiments.

To obtain a clear and uncomplicated picture of the effectiveness of the pertussis vaccine I omitted entirely the blood injection in my second group of patients. This group consisted of sixteen patients, four of them of the "status asthmaticus" type, ward patients in several New York hospitals where the attending physicians were kind enough to permit a trial. I started with 0.1 cc. of the vaccine (one billion organisms) given subcutaneously, and continued with this dose twice weekly for several weeks. When this dose caused a constitutional reaction it was decreased. (Later it was gradually increased until 0.5 cc. was reached.) In several cases I used much larger doses, but I found that the smaller ones were just as effective and much less likely to cause reactions. (In all cases I used the pure, single strength vaccine prepared by Squibb.) If after four injections the patient did not show definite signs of improvement further treatment with the vaccine was usually of no benefit.

Reactions

The reactions following the vaccine treatment may be of general systemic or focal nature. A high temperature up to 104° F. may appear after the second injection. It requires no treatment and will subside within three to four days. With the smaller doses I did not observe a single rise in temperature.

Some patients complain of pain in the area where the injection was made. One patient developed what looked like a cellulitis with swelling of the axillary lymph glands, which subsided after three days without any treatment.

Nearly all patients report an increased expectoration of a greenish purulent sputum in place of the previously viscid and glassy material. In one patient it became hemorrhagic.

Moist râles may be heard over both lungs where previously only rhonchi were present. These auscultatory changes with the accompanying high temperature in three patients made me suspect some bronchopneumonic infiltration, which, however, could not be confirmed by x ray examination.

Special Examinations

No attempt has been made to investigate these patients along allergic lines. Since practically all of them had been suffering from asthma for some time and had been thoroughly studied in more than one clinic or hospital, I did not see any reason for repeating the same procedure.

However, blood counts, sputum examinations, and intradermal skin tests with 0.01 cc. of the vaccine were made on most of these patients. Fractional gastric analyses were made on six patients who consented to a provocative histamine test. In these six patients injected with one mg. of histamine I was unable to provoke an asthmatic attack. The total acidity and the free hydrochloric acid were within normal limits. The skin reactions were positive in about fifty-five percent of the patients. In several patients the reaction was delayed, appearing about twelve hours later in the form of an erythema of the size of a silver dollar. The blood showed a consistently high hemoglobin reading, never lower than fifteen grams. The white cell count was usually about 8,000; the percentage of eosinophiles ranged from four to twenty-eight percent, on the average about eight to twelve percent. The eosinophile level, however, bore no relation to the severity of the disease.

The following case reports illustrate the effect of the pertussis vaccine in the three groups of asthma.

Group A: Patients with Severe Asthma

R. S., twenty-seven years old, female, single, a garment worker. The family history was negative. The patient had had measles and whooping cough in childhood, and frequent colds.

The first asthmatic attack appeared about two years ago while the patient was working in the factory. At that time she was taken to the Kings County Hospital, where she remained for about six weeks. Afterwards she attended the asthma clinic for nearly a year, where she received some vaccine treatment besides injections against dust.

Six weeks ago she suffered a relapse. The attacks were so severe that hospitalization became necessary. Adrenalin, aminophyllin given intravenously, atropine, luminal, morphine, and oxygen were tried, but with little relief. With the consent of the attending physician it was decided to try the pertussis vaccine treatment.

The more important physical findings were: Nutrition poor, patient's weight being ninety-four pounds. Temperature was irregular during patient's stay in hospital, remaining normal for a few days, then suddenly rising to 101.5° or 102° F. Pulse rate was 124, regular and feeble. Scoliosis of the spine was present with a pronounced deformity of the right side of the chest. Examination of the heart revealed a normal rhythm, with a soft systolic blow at the apex. Examination of the lungs showed diffuse dry râles over the entire field of both lungs.

Laboratory data: Wassermann test was negative. Blood sugar, 90 mg.; urea nitrogen 18 mg. Urine showed a 2 plus albumen. Blood count: white cells 13,500, with forty-nine polynuclears including eight percent staff cells, twenty-seven percent lymphocytes, two percent monocytes, and twenty-two percent eosinophiles. X ray examination was negative except for the usual changes seen in asthma. The skin test with 0.01 cc. of the vaccine gave a doubtful reaction.

All medication was discontinued when the treatment with the pertussis vaccine started. Following the first injection (0.1 cc.) definite improvement appeared that night. The patient was more restful, her cough not so frequent. Two days later another injection was given. The following day the patient began to expectorate more freely; the temperature, which at the beginning of the treatment was 101.5° F., began to decline; the wheezing, although still present, was mostly confined to the bases. After the third injection the temperature returned to normal and all wheezing disappeared. Three days later the fourth injection was given and the patient discharged. She left the hospital free of any asthma-symptoms.

Altogether nine patients were treated in this group. In eight the asthmatic attacks were completely controlled after two injections. One patient was only improved. The number of adrenalin injections required to keep this patient relatively comfortable dropped from seven to one or two a day. This patient received eight vaccine injections but he never became symptom free. The hospital diagnosis was status asthmaticus, periarteritis nodosa.

Group B: Patients with Active Asthma

S. P., a boy three years old. His father had asthma. There was no history of whooping cough, but while his older sister was sick with the "whoop" he received several vaccine injections for immunization. In December 1939 he had lobar pneumonia; two months later he was readmitted to the hospital with bronchopneumonia. In May 1940 he suffered his first asthmatic attack and was readmitted to the hospital. Later he attended the asthma clinic for some months. In September he again returned to the hospital on account of a severe asthmatic attack.

The skin tests performed in the hospital with the common allergens were all negative except for a slightly positive reaction to dust and feathers. He had some vaccine treatment but without any benefit. The attacks now appeared about every week or every two weeks and required adrenalin for relief.

On examination the only notable findings were a nasal obstruction due to congestion, and the presence of dry râles over both lungs. The skin test with 0.01 cc. of the vaccine gave a four plus reaction. The blood examination showed a hemoglobin of fifteen grams, with 8200 white blood cells, of which forty-six percent were polynuclears, forty-three lymphocytes, three percent monocytes, and eight percent eosinophiles.

Following the first few injections the wheezing disappeared, and no asthmatic attacks have since developed. It is nearly two years now since he had his last attack, before the treatment was started. The patient continued with the treatment for about six months.

This group comprised eight patients. The asthmatic attacks occurred sometimes every day, sometimes once a week or at longer intervals. Only one patient, a woman about fifty years of age, who had several attacks a week, failed to respond to this treatment after six injections.

Group C: Patients with "Abortive" Asthma

S. M. K., a woman, twenty-seven years old, married, an office worker. The patient's family history was negative. She had had measles and chickenpox in childhood, and ten years ago was operated upon for acute appendicitis. She had suffered from hay fever for the last sixteen years, which usually began in August and lasted until the end of September; she also had mild "rose fever" in May. The desensitization treatment, carried out for years, failed entirely.

Six years ago the patient suffered her first asthmatic attack. It had been suggested that a freshly painted stove was responsible for the attack, since no other explanation could be found. The patient continued the hay fever treatment, when one day, about two hours after an injection, she suffered a severe asthmatic attack which was relieved by an adrenalin injection. The hay fever treatment was continued, but with smaller doses. However, even with the decreased dosage, attacks would appear very often about two hours after the injection, and for this reason she discontinued the treatment.

Since that time the attacks have appeared at irregular intervals and have varied in intensity. Sometimes an adrenalin injection was necessary to control the attack, but usually, until about four months ago, ephedrine had been effective enough to relieve the dyspnea and wheezing. As a rule the attacks appeared early in the morning or during the day after some exertion, and were limited to wheezing and dyspnea. Lately the attacks began to appear more frequently, several times in a week, and ephedrine failed to afford relief.

Physical examination was entirely negative except for the wheezing. Blood count: Hemoglobin, 15 gm.; red blood cells, 4,430,000; white blood cells 7800, with sixty-nine percent polynuclears, including seven percent nonfilamented cells, twenty-three percent lymphocytes, three percent mononuclears, and five percent eosinophiles. The skin test with 0.1 cc. of the vaccine gave a doubtful reaction, a small erythema which twelve hours later was increased to the size of a silver dollar.

With the beginning of the treatment the patient was advised to discontinue all medication. After the first injection the wheezing that night lasted for only about five minutes; formerly it had lasted for several hours, even with the help of the ephedrine which she took for relief. After two more injections the wheezing and dyspnea ceased entirely. The patient can now walk up stairs without the slightest discomfort. Recently "just to convince herself" she took a four mile hike without experiencing any shortness of breath.

Five patients were treated in this group. Two patients failed to improve after receiving six and eight injections, respectively.

Comment

There are grave doubts whether the two patients who did not respond to the vaccine treatment were really asthmatics. Both were women of nearly sixty. They had a moderate degree of dyspnea and all signs of a chronic bronchitis dating back to the grippe infection in 1918. They never had experienced a real asthmatic attack, either prior to the grippe or afterwards. In one patient, in spite of a very careful search, not a single eosinophile cell could be found in the blood smear; the other patient had an eosinophilia of three percent. The skin reactions to the vaccine were negative. A subcutaneous injection of adrenalin was without any effect. The only reason they thought they had asthma was that the medical clinic referred them to the asthma clinic for treatment.

Results

In analyzing the results of this treatment it is necessary to look at it from two angles: A, From the viewpoint of immediate relief, and B, from the viewpoint of permanency. In other words, does this treatment represent a cure?

It is with great reluctance that I take up this point. I would prefer to withhold my comments until at least a few hundred patients have taken the treatment and enough time has elapsed to justify such conclusions. In my experience of the last three years, however, one fact seems to stand out: Patients in the "status asthmaticus" phase are as a rule relieved within forty-eight hours after the first injection and their asthmatic attacks controlled with two to three vaccine injections. Patients belonging to the two other groups also benefitted from this treatment. Relapses have occurred in groups A and B, none so far in group C. Whether these relapses were due to insufficient treatment or whether they would have occurred even after a prolonged course of injections, I do not know.

Four patients who continued with the treatment for three to six months have been completely free of all asthmatic symptoms until now, a period varying from one to three years.

Discussion

I have often been asked by my colleagues: Yes, but what is the "rationale" of your treatment?

When I decided to try pertussis vaccine in my first case of asthma I was more interested in relieving a suffering patient than in building theories. After analyzing and reanalyzing the clinical symptoms of whooping cough and bronchial asthma I saw a striking similarity between the two diseases. This formed the basis for my "rationale". In the final analysis the histamine or "H" substance theory of asthma is fundamentally based on the same principle.

However, several theories can be advanced to explain the apparently good results obtained so far with the pertussis vaccine. All revolve around the clinical picture of pertussis and the biology of the Hæmophilus pertussis organism.

1. It is quite possible that *these* patients became sensitized at some time to the pertussis bacillus. Almost all patients gave a history of pertussis infection in the past. Sensitization would have taken place in the bronchial mucosa, since the respiratory tract is the selective site for the Hæmophilus pertussis. The frequency of the positive skin reactions, if any value can be attached to them, tends to support this possibility. This, then, would be in complete agreement with the allergic theory, and the treatment described above would represent simply desensitization.

2. The pertussis bacillus with its special affinity for the respiratory tract has the ability to transform a normal mucous secretion into a viscid tenacious mucilaginous substance (common to pertussis and asthma). This is probably due to some ferment-like substance elaborated by the bacillus. Treatment with pertussis vaccine may cause the cells of the bronchial mucosa to produce specific antibodies which neutralize or inactivate this "mucogenic" factor, regardless of the nature of its cause. The experiments conducted by Toomey (2) with cultures of the Hæmophilus pertussis bacillus would support such an assumption.

3. A third possibility can also be considered. When the patient is inoculated with pertussis vaccine the bronchial mucosa, as the sensitized tissue, is forced to form new antibodies, and thus becomes "exhausted" and fails to react with the "asthmagenic" allergens. If this explanation is accepted the basic principle for this treatment lies in the use of an antigen which has a special affinity for the bronchial tissue.

That the favorable response to the pertussis vaccine treatment is not due to the effect of a nonspecific foreign protein is supported by the fact that most of these patients had had a series of vaccine treatments, with autogenous as well as stock vaccines, for many months, and not only did they not show any improvement but more often became worse.

That the favorable results are not related to the febrile reaction is proved by the fact that in seventy percent of the patients treated with the pertussis vaccine, no such reaction occurred. Again, the number of successes reported is too large to be explained by the fever episode.

Conclusions

Twenty-two cases of bronchial asthma treated with pertussis vaccine are reported. The mode of action of this therapy is as yet incompletely understood. How-

ever, the treatment is harmless and simple. It is hoped that men who specialize in the field of asthma and have ample clinical material and institutional facilities will subject this treatment to a careful and impartial clinical test, particularly in patients of the status asthmaticus group resistant to ordinary therapy.

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THE MERCIFUL COLOSTOMY

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Venereal diseases have assumed a more vital rôle in this day when men in the armed forces have, as a result of physical examinations, been found to be suffering from the various diseases in this field. Prostitution has also played its part, especially in near-by camps where the contact is more acute. Lymphogranuloma venereum then, may come into its own, and its prevalence may be more accurately determined. Hence, hitherto known as the sixth and later the fourth, now it is classified as the third venereal disease. In other words, venereal lymphogranuloma has risen in the scale of occurrence because it is now more readily recognized. The day may come when the Frei test will be as common a procedure as the Wassermann in the establishment of diagnosis.

This paper, however, is to deal rather informally with the question of colostomy as a means of therapy from the palliative viewpoint, for as yet there is no really satisfactory treatment for this disease, especially in its later stages. I am aware of the horror the average patient, or even the doctor for that matter, has for the prospect of a colostomy. The mere thought of having to defecate through an artificial opening is revolting, and tends towards social ostracism, but this need not necessarily be the case. It is granted that if the patient must look forward to carrying a bag of feces around with him for the rest of his life, the future cannot hold out the most pleasant picture. This apparatus which has been used in the past, however, is now discarded by the modern surgeon. I shall attempt to point out here that the colostomy operation for a complete or near complete stricture of the rectum may be considered as a merciful measure, aimed at a general restoration of health by shunting the fecal flow so as to prevent continual soiling of an already completely soiled area. It may then be possible, by means of the sulfonamide drugs which are now so popular, to clear up local infection and to exert other means to keep the part clean. When the rectum is regarded as a fertile source of focal infection, a fact that has not been given enough space in medical literature, then the importance of these suggestions as related to other parts of the human system may be measured.

The anorectal phase of the disease known as venereal lymphogranuloma is perhaps the most important phase from the viewpoint of morbidity, infection, interference with function and possible effect upon other organs. Also, the patient often does not consult a physician until obstipation or marked constipation has occurred, or until finally, after a host of other treatments, x ray examinations, and prolific prescribing of drugs, a digital examination of the rectum and anus has been made. It is then that a well developed stricture may be found which has contributed to or been responsible for the train of symptoms complained of throughout the years. This occurs far too often to pass off lightly as a rare mistake and those of us who are in the field, I am sure will bear out the truth of these statements.

At the anorectal phase of the disease, then, one finds that his patient is extremely sick; is rundown, has lost weight, has no ambition, no energy, is arthritic, anemic, and usually undernourished. One also finds that often no rectal examination has been made, hence the disease has not been recognized in its earlier stages. The marked development of fibrosis, which is characteristic of the disease features, has built up a solid wall of resistance in an area which normally has room for expansion, movement and patency. This wall of resistance has naturally interfered with function of the part to such an extent that a satisfactory stool is impossible at any time, regardless of the use of cathartics or enemata.

If this were all, the picture would not be so bad, but unfortunately there are other things. It so happens that the rectum and colon are lined with a mucous membrane, which has as one of its properties, the power of absorption. Fluids are absorbed in the colon, anesthesia may be given per rectum, food may be ingested per rectum. Every doctor is aware of these happenings and also aware of the absorption of toxins that occurs as a result of stasis in the colon and rectum, such stasis caused directly by a stricture of lymphogranuloma venereum origin. This stasis may be present in the rectum or may even extend high above into the colon producing a colitis, thereby making for a more complete and thorough absorption of toxic material. There is no doubt the above-named sequence of events is largely responsible for the train of symptoms complained of by the patient and it is easily understandable that these signs and symptoms may have been present for a protracted period without discovery, thus accounting for the usual chronic picture encountered.

It also happens that occasionally, as a result of prolonged infection of these areas, ulceration appears which may approach the proportions of a cellulitis or may restrict itself to stercoral ulcers of the rectal or colonic mucosa. In the former case there may be a widespread pathological condition involving neighboring organs or tissues; and in the latter case such ulcers may form sinuses or fistulas which may connect with neighboring organs or tissues. And so abscesses may be set up in the associated lymph spaces and it will be readily seen that these abscesses may produce foci of infection. Pocketing may be present and those pockets may communicate with the outside skin or other areas, as the rectal or anal lumen, and slow drainage often relieves pressure caused by the abscessed cavity. Thus a

patient may for years harbor such foci of infection which may be multiple and far-reaching in effect. The rhythmic insult of bacteria laden feces, which must or should daily pass over these areas which are already infected, does not allow for any attempt at healing. Conversely, such irritant action further tends to make the situation more serious in spite of Nature's effort to set up a fibrosis, for other avenues of infection are continually being opened up for a further progression of the disease.

In cases where the stricture is of the annular variety, the damming back process is not so severe, and though drainage is not complete it is not interfered with as greatly as in the case of the tubular variety of stricture, which often may involve considerable lengthwise coverage of the rectal tunic, in some instances reaching as high as or above the sigmoid. The anal stricture may be so complete as to cause a stenosis at the outlet with not so much involvement of the rectum proper, although here again, lack of drainage may be responsible for stasis and its after-effects.

Aside from the infective process which plays a rôle which we all understand, one must not forget the sequence of pathological events which characterizes lymphogranuloma venereum, namely, irritation, infection, suppuration, fibrosis and stricture formation. This sequence seems to be present wherever lymphogranuloma venereum may be found, whether it be in the Frei test, the inguinal adenitis, or the rectal stricture. How to reckon with this fibrosis seems to be a problem, as the various "fibrous diluents" appear to be such in name only and in the position of fibrosis of a patent tube, such as the rectal tube, fibrosis is detrimental, to the extent of interference with function of the part. The use of bougies, dilators, electrotherapy, etc., may have a place in selected cases, but during the slow process of correction by this means, there is still the soiling of the part which continues as explained above and the morbidity already caused by the virus of lymphogranuloma venereum and its subsequent associates is not abated as far as irritation and further infection through other avenues are concerned. The sulfonamides no doubt help in ridding the body of some of the offending organisms and the completeness of this effect is still debatable by some. Even the therapeutic administration of Frei antigen which seems to be favored by some workers does not correct the damage already done by the fibrotic process and how far this process has developed no one can say.

Since, as a rule, the major activity of this disease is found to be in the pelvis and the genitals, notwithstanding the fact that the lymph of the whole body may in time be affected, it seems that any procedure which would tend to keep that part as clean as possible should be desirable. It is here that a discussion of the colostomy question appears apropos. The colostomy deflects the fecal flow so that further irritation for new and further infection may be minimized. It is at this time that further attempts at cleansing the area may be put into use, such as irrigations, topical applications, etc., in conjunction with sulfonamide therapy. The rhythmic fecal flow may thus be continued regularly and completely and the absorption of toxic material lessened. These patients usually "pick up" quickly and gain weight and the mental attitude is also improved.

Regardless of the common conception of the stigma of a colostomy operation, for the sake of the health of the individual and in view of the picture as outlined above, it is suggested that the colostomy may be considered a merciful procedure rather than an emergency operation. It is usually performed when all other means of therapy have failed and, because of the damage already done, the effect of the operation is not as satisfactory as it would have been at an earlier period. It rests with the surgeon and with the progress of the case as to whether a subsequent operation may be performed to re-anastomose the severed intestine. If it is possible to create a more patent strictured opening, which ought to obtain, as a result of treatment and gentle dilatation without the annoying feature of continued soiling, then it may be that a functioning rectum and anal canal may finally be achieved.

The most difficult part of this whole program may be the convincing of the patient that this colostomy operation is the one of choice and it is admitted that at this time such argument may be difficult to present. It should be explained that the use of an artificial anus is not as inconvenient as it sounds; indeed it is not. Patients who are properly instructed do not find the colostomy too distasteful. Persistent argument and intelligent explanation may induce the patient to submit to a colostomy operation. A stoma which is healthy and which is not allowed to stenose may be cleansed easily, and a simple light bandage applied over it, which may be worn as a belt, does not give the least hint of its presence. Also, herniation does not occur as frequently as when some of the cup-like apparatuses are used which predispose to herniation. An enema in the morning and perhaps a small wash-out at night should suffice and prevent any accident during the day, thus permitting any activity during work hours. The diet should be regulated so that bowel movements would not be encouraged.

These people are unconsciously chronic invalids, and although they do not hobble about on canes, it may be proved by thorough investigation that certain visceral organs suffer impairment of function and are chronically crippled in the performance of their separate duties.

In order to spare the patient the frequent bloody and pussy stools, the toxic absorption and morbidity of focal infection, the multiple fistulas often involving the vagina or vulva, the colitis and straining at defecation, the tearing of scar tissue in attempting dilatation and the mental torture of "not being able to be cured", the colostomy operation for certain types of lymphogranuloma venereum strictures may be truly considered an act of mercy.

1516 NORTH SEVENTEENTH STREET

First Aid Treatment of Joint Wounds

In all joint wounds the wound must be protected from further external infection and the joint immobilized. In addition it is usually necessary to give antitetanic serum and treat general symptoms such as shock and pain by the appropriate methods. Moderate hemorrhage may be controllable by local pressure produced by bandaging, but if the main vessel of the limb is bleeding, a tourniquet must be applied temporarily. A first aid aseptic or antiseptic dressing should be applied without unduly disturbing the wound. Immobilization should be attained by splinting, if possible. For the lower limb a Thomas knee splint is satisfactory, while for the upper limb a Jones or an angular splint may be used. No further treatment is needed until the patient is placed under good conditions for surgery.—V. Zachary Cope, *Brit. Med. Jour.*, May 23, 1942.

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NONPENETRATING NONFATAL TRAUMATIC HEART DISEASE*

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The possibility of the existence of heart disease consequent to nonpenetrating injuries of various degrees to the chest wall is a most appealing subject to the lawyer, the patient and the doctor. The purpose of this paper shall be confined to the presentation of the views of various protagonists and antagonists upon this subject; and then to offer our own conclusions based upon both the bibliography and upon a number of our own cases, the merits of some having been judged by judge and jury (though admittedly such conclusions might be fallacious). Traumatic heart disease, with or without fatal issue, following penetrating injuries and severe crushing, is not included within the scope of this paper.

We have carefully scrutinized the literature, have consulted with the physiological departments of two large metropolitan universities, and have not found the answer to one perplexing question. This question answered would solve theoretical discussions and would serve as a scientific premise from which the investigator could more adequately and more reasonably determine the presence or absence of heart disease following nonpenetrating injuries of the heart. The thoracic cage, at any one point, in all complexity, receives an injury, a blow, of perhaps ten foot pounds! How much of this tension, or blow is transmitted from the site of injury through the ribs, the cartilages, the muscles, the tendinous attachments, the vertebral column, etc., to any one point within the thoracic cage? How much is actually disseminated and lost through all the resiliency of the above named structures? How much of this injury or blow actually passes these shock absorbing organs and manifests itself upon the freely swinging muscular heart? Muscle tissue, cartilaginous tissue, bone structure, resilient tendinous fibers, etc., all reasonably serve to absorb and disseminate the aforementioned ten foot pounds of a blow or injury. To reiterate, then, how much of the original ten foot pounds actually injures the myocardium? Are pre-existing myocardial disease, valvular disease, and arteriosclerosis necessary adjuncts? Does a psychoneurotic personality play a part? These questions and a host of others remain unanswered because of a lack of acceptable scientific research amongst those who have the proper laboratory facilities for such investigation. Thus, merely by interpolation and intellectual necessity will an answer be forthcoming and attempted at this time. How fortunate indeed are those who possess well equipped laboratories!

A review of the literature containing the thoughts of various investigators as to the protection afforded the heart within the thoracic cage and as to nonpenetrating injuries resulting in heart disease is now presented, and some pertinent statements by them will be commented upon by us.

Literature

Kulbs (1), in 1909, showed that blows of different strengths on the anterior chest wall could produce injury to the heart. Dull blows over the precordium in experimental animals could produce hemorrhages and tissue damage in the heart without injury of any sort to the skin or thoracic wall.

Beck and Bright (2), in 1934, stated that the heart lying against the sternum is vulnerable to any sudden impact over the sternum, and, buttressed against the bodies of the thoracic vertebræ posteriorly, is vulnerable to compression forces applied to the chest.

Schlomka (3), in 1934, concerned himself with experimental nonpenetrating injuries to the heart of animals. He found that abnormalities in the electrocardiographic readings, blood pressure and x ray examinations closely paralleled each other in degree and that they varied in extent according to the severity of the original trauma.

Beck (4), in 1935, exposed and contused the hearts of dogs with resultant myocardial injuries, and noted electrocardiographic changes similiar to those obtained in coronary artery occlusion but having a tendency to return to normal.

Gonzales, Vance and Helpern (5), in 1937, stated that the heart is a compact spindle shaped mass of constantly moving muscle which lies on a soft yielding bed and is well protected by the bones. Conditions are such that the heart cannot be reached by a crushing violence unless the force is exceptionally severe.

Brahdy and Kahn (6), 1937, have stated that the subject of traumatic heart disease should be of an in-

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vestigative nature and not depend upon the decisions of a court. There was to be no conclusion of a case without the consideration of:

(a) The physical and psychic condition of the patient prior to his injury.
(b) The type, site, and severity of the injury.
(c) The immediate effects of the injury, both subjective and objective.
(d) "Bridging symptoms", or the course of the traumatic symptoms from the injury to the onset of the alleged disease.
(e) The latent period of the disease.
(f) The diagnosis of the disease, its mode of onset, the site of the injury, and its course.

Robey (7), in 1938, stated that hearts already diseased at the time of the injury seem more readily disturbed by precordial blows than healthy ones.

Leinoff (8), in 1938, stated that the clinical recognition for diagnosis of traumatic heart disease rests upon:

(a) History of trauma to the chest.
(b) Dilatation of the heart.
(c) Poor, distant rapid sound—tic-tac rhythm.
(d) Failing arterial pressure with rising venous pressure.
(e) Symptoms of impaired cardiac function within a reasonable time of injury.
(f) Serial electrocardiographs showing changes.

Spicer (9), in 1939, classified nonpenetrating traumatic heart disease:

(a) Injury to the pericardium: 1, acute pericarditis; 2, chronic pericarditis.
(b) Injury to the myocardium: 1, rupture; 2, contusion.
(c) Injury to the heart valves—endocarditis.
(d) Injury to the aorta: 1, rupture; 2, aneurysm.
(e) Extrasystolic arrhythmia.
(f) Auricular fibrillation.
(g) Auricular flutter.
(h) Heart block.
(i) Tachycardia.
(j) Bradycardia.
(k) Myocarditis.
(l) Coronary disease.
(m) Angina.
(n) Heart strain.

Smith and McKeown (10), in 1939, stated that a diagnosis of traumatic heart disease is justified when a patient receives either a direct or an indirect blow to the chest, or undergoes undue physical strain, or is subjected to other types of external violence and then develops, without any other apparent causes, circulatory embarrassment, or other clinical or electrocardiographic signs of heart disease. Cardiac contusions, they stated, in this automobile age are too frequently overlooked.

Bishop (11), in 1940, stated that trauma is an important factor in the consideration of diseases of the heart. Direct injury to the chest wall with resultant trauma to the heart has undoubtedly often been overlooked clinically, but is now coming to be recognized with increasing frequency.

Warburg (12), in 1940, stated that fifty-nine new cases (plus two hundred and two others) of myocardial or pericardial damage due to nonpenetrating blunt injuries had been collected. In almost all the cases the injury involved the thorax, fracturing one or more ribs; but in a small proportion, the injuries distant from the heart were responsible for cardiac damage.

Burstein and Marshak (13), in 1940, stressed the value of electrocardiographic examinations in establishing the diagnosis of contusion of the heart and indicated their value in chest injuries. The precordial lead was found most valuable and presented the earliest and most constant finding.

Structural cardiac lesions and abnormal cardiac function occur as the result of severe blows upon the chest, as well as crushing injuries, and these result in usually transitory disturbances of rhythm, temporary changes in the S-T segments and T waves (14).

Gray (23), in 1935, stated that it was unreasonable to presume that the heart may be seriously jarred by a blow or fall, because it is suspended from its great blood vessels, hangs freely within its covering sac, and continually undergoes violent motion of its own throughout life.

Coffen (26), in 1930, described a case of complete heart block occurring in a child and persisting for seven years with a remarkable and unexplained recovery. The patient had suffered a fall and had fallen upon her chest. White similarly stated that heart block could result from trauma upon the chest wall. Yet it is our thought that the production of so deep a myocardial injury would entail a most severe form of injury, and would, in a vast number of cases, result in death. Recovery, in the main, would indeed be extraordinary and exceptional.

Beck (4), in 1935, reported typical attacks of coronary occlusion with characteristic laboratory findings following trauma to the chest wall. Direct trauma or violence to the chest wall may produce traumatic rupture of any of the valves and chordæ tendinæ. However, most of these cases result in a fatal issue. Those patients who survive will manifest a host of changes, evidence a great number of laboratory signs, and when healing eventually occurs, the signs may not be indistinguishable from valvular lesions due to natural causes. This has been discussed at great length by Kissane, Koons and Fidler (28), in 1936, and by Kissane himself (27) in another paper, and by Barber and Osborn.

White (29), in 1937, stated that flutter is commonly precipitated by sudden effort, excitement, trauma or surgical operation.

Warburg (30), in 1938, stated that if symptoms of cardiac disease occurred shortly after a nonpenetrating trauma of the chest, or even later (as a rule within a year), there was always a possibility that the myocardium had been injured, causing subacute and chronic disease. The appearance of arrhythmia perpetuus or congestive heart failure, speak especially in favor of this diagnosis. He further stated that paroxysmal tachycardia, auriculoventricular block or angina pectoris should arouse suspicion. To us this appears as rather a too liberal viewpoint and interpretation of heart disease occurring at so great an interval between the alleged resultant heart disease. Few authors concur with Warburg.

White and Glendy (25), in 1937, stated that "occasionally, with little or no trauma or strain, there may occur a rupture of the heart wall, of the aorta, or of the valves". "It is of the utmost importance to realize that these serious and often fatal accidents occur even

with the patient at complete rest in bed". "This much, however, may be stated with assurance. A bruise of the heart muscle that is too slight to cause any characteristic symptoms or signs (including newly acquired cardiac enlargement, as shown by roentgen ray or electrocardiographic anomalies which in turn are to be carefully distinguished, as far as possible, from electrocardiographic changes which are not acute and were present before the injury), other than those of neurocirculatory asthenia or cardiac neurosis, may be dismissed as wholly unimportant or as nonexistent.

Barber (31), in 1941, states that most experiments relating to strain or overstress of the heart have proved that all parts of the healthy heart are capable of withstanding considerable strain!

Leaman (32), in 1941, stated that nonpenetrating traumata are capable of causing serious cardiac injury but, by no means the least important of all, the accident may initiate in a patient of the proper pattern a train of symptoms of a psychoneurotic nature that will center about the cardiac mechanism and greatly complicate the situation! He advocates a complete cardiac study in each case whenever cardiac injury is suspected, especially when psychoneurotic factors are in evidence.

Barber (31), in mentioning and discussing some of the cases reported by Hay and Hones, Kahn and Kahn, Kissane, and some of his own, concludes that auricular fibrillation is a definite disability which may result from trauma either in the form of direct violence or more commonly from overexertion. When the disability is the result of overstrain, there is distress at the time with dyspnea on slight exertion. In those cases due to direct violence, the cardiac symptoms may be masked by the shock of the trauma, and there may be delay before the fibrillation is recognized. The latter statement is vehemently questioned by us and we doubt that shock of an associated trauma may mask this arrhythmia, yet we have seen cases of auricular fibrillation following cardiac trauma.

A fairly active association in the clinical practice of heart disease, especially in reference to the socalled traumatic heart disease, and a more than passing acquaintance with legal procedures, compel the following criteria in formulating an expert opinion as to the cardiac status following nonpenetrating and nonfatal injury to the heart, and, in brief, the following considerations must necessarily be completely answered:

1. Complete and thorough previous and personal history, habits, and environment.
2. Exact nature and occurrence of injury for the purpose of eliciting a causal relationship.
3. All manifestations, both subjective and objective, at the moment of injury and immediately thereafter.
4. All manifestations within a reasonable time of the occurrence of the injury—approximately seven days.
5. Complete physical examination.
6. All inclusive laboratory procedures, i.e., frequent electrocardiographic examinations, daily for three or four days, and then at weekly intervals; fluoroscopy, vital capacity on several occasions, circulation rates, arterial tension, sedimentation rates, response to exercise, and blood studies.
7. Emphasis upon exaggeration, malingering, and the possibility of psychoneurotic personalities.
8. Presence of preexisting cardiovascular disease in any of its manifestations and its aggravation due to injury.
9. Traumatic neurosis.
10. Reasonable, nonemotional, impersonal evaluation of the entire data.

A clear insight into the personal history, habits, and the environment of the patient will distinctly aid in an impersonal evaluation as to exaggeration of the symptom complexes, and as to the presence of a psychoneurotic factor, particularly so if legal steps are contemplated.

Subjective manifestations, such as pain, dyspnea and palpitation immediately after, must be closely scrutinized and evaluated; and proper laboratory procedures must be instituted to obtain a clear and accurate verification of either the patient's complaints or the doctor's clinical opinion. The normal heart (15) performs its function quietly and, except under such circumstances as violent exertion or emotional excitement, the individual is never conscious of its action. This is equally true of many patients with actual organic heart disease, especially those with lesser degrees of valvular deformity. But the heart is one of the favorite "shock" organs or outlets for many varieties of neurogenic stimuli, and symptoms referable to it occur frequently in the absence of any heart disease whatsoever; when symptoms pointing to the heart develop, the patient is only too ready to believe that heart disease is present, and it requires but a word from his physician or lawyer to accentuate and perpetuate this belief. In the succeeding paragraphs it is our purpose to point out that the commonest symptoms of heart disease, i.e., pain, dyspnea and palpitation, are often present, not only in the presence of a normal heart, but in the absence of any organic cause anywhere in the body.

It is probably not an exaggeration to say that the majority of complaints of pain in the region of the heart are not of cardiac origin. Passing over such other organic causes of pain as cardiospasm, gallbladder disease, intercostal neuritis, either intrinsic or resulting from disease of the vertebral column, pulmonary and pleural diseases, and the low substernal distress of heartburn or gastric flatulence, there remains a large number of cases in which neither heart disease nor disease of any neighboring structure is the cause of pain in the neighborhood of the heart. These cases often can be distinguished only after a very careful study, but the single most valuable measure for diagnosis is a carefully taken history in an attempt to obtain a complete description of the symptoms.

A squeezing type of retrosternal pain which comes on with effort, radiates to the shoulder and perhaps down the arm, which subsides with rest, and is more apt to come on with a large meal, or on a cold windy day, is not difficult to recognize as the pain of coronary insufficiency. But the pain of a different character, such as the stabbing or sticking pain, or sense of soreness located directly over the heart and centering in the left breast, without radiation and which is not related to effort or meals, while more common than the serious pain just described, is almost invariably not of cardiac origin. It is the pain occurring in patients of neurotic taint and its pathogenesis is probably an oversensitivity of the chest wall (16). It is often associated with precordial tenderness, a condition which is not found in

true heart disease. Sometimes an extrasystole in an individual, whose cardiac nervous pathways have been oversensitized by some form of anxiety neurosis—particularly following an injury to the chest wall—will result in the production of a stab of precordial pain instead of the more usual sensations associated with an extrasystole. Often the nervous background for this type of complaint is the death or recent illness of some member of the family from heart disease, or injury to the chest wall for which advice has been sought.

Dyspnea is the outstanding symptom of heart disease, but its occurrence in pulmonary disease, especially in chronic bronchitis, pulmonary fibrosis and emphysema, and asthma calls for caution in the diagnosis of heart disease in the presence of these conditions. It is here that the determination of venous pressure and circulation finds its greatest field of usefulness. However, even after these conditions have been excluded, there remains several forms of functional dyspnea which, unless the examiner is wary, will lead to an erroneous diagnosis of heart disease.

Dyspnea, on exertion, is a fairly common complaint among the obese, purely as a result of the extra load the musculoskeletal system is asked to carry, and of the elevation of the diaphragm (17). Unless some other evidence of heart disease is found, the symptom, dyspnea, by itself, in an obese individual should be interpreted with great caution. There are two other forms of dyspnea of purely functional nature which may be misleading. One is the sighing type of respiration found in neurocirculatory asthenia. The patient will complain that he feels as though he cannot get enough air, and is given to taking deep sighing respirations. This complaint is usually worse in warm weather. Along with this symptom go other stigmata of this functional condition; cold, sweating hands, nervousness, easy fatigue, precordial distress and palpitation.

Attention has recently been called to the importance of hyperventilation (18) as a form of respiratory neurosis in precipitating symptoms resembling those of organic disease. While this is really not a form of dyspnea, it is included here because symptoms of angina pectoris may be precipitated by this means, and if the patient is observed during an attack, the complaint of chest pains plus the appearance of the patient with the deep and accelerated respirations may cause a mistaken diagnosis of serious heart disease. It is important, therefore, to determine whether the respiratory abnormality is true dyspnea.

Palpitation is consciousness of heart action and is a common complaint among noncardiacs as well as cardiacs. It is very troublesome only among those of a more nervous and introspective disposition. It occasionally occurs with a perfectly normal cardiac rhythm, especially if the rate becomes momentarily accelerated as the result of physical activity or with sinus arrhythmia. As distinguished from palpitation occurring with abnormal rhythm, this form is liable to have a more gradual onset and offset, although this is not invariably the case. It is the present opinion that almost any form of abnormal rhythm found in diseased hearts can be found in structurally normal hearts (17). This includes extrasystoles of all types, auricular fibrillation, and, more rarely, flutter, and paroxysmal tachycardias of all types. Extrasystoles in a sensitive individual cause an unpleasant sensation of the heart appearing to "stop or "turn over". As noted above, in some the sensation is converted into one of actual pain. The other forms of paroxysmal rhythm are discovered usually because of palpitation they cause, although some faintness or syncope occurs. An electrocardiogram taken during an attack of palpitation will reveal the type of rhythm, but it is important to note that this does not in itself constitute a diagnosis of heart disease. Unless there is some other evidence as to the presence of one of the common etiological factors of heart disease, as arteriosclerosis, hypertension, hyperthyroidism, or a history of rheumatic fever, a diastolic murmur or a systolic murmur of more than minimum intensity, fluoroscopic evidence of cardiac enlargement, or electrocardiographic evidence of myocardial disease, a diagnosis of organic heart disease should not be made.

Clinicians have recognized both an immediate and a delayed onset of these subjective manifestations; in the former, they resemble those of an acute coronary closure, and in the latter the symptoms appear at varying intervals, usually within seven days, depending upon the size, the location and the progress of the myocardial disease. However, it may be emphasized that contusions of the heart actually producing myocardial damage should easily be ascertained upon careful laboratory investigations as suggested previously and as will be discussed in this paper; the converse is equally a truism, that is, a thorough negative analysis should and does exclude a diagnosis of cardiac trauma and in its place should be substituted the real diagnosis of traumatic neurosis.

Associated with all the foregoing, and properly evaluated, many laboratory procedures are readily available. The electrocardiogram is of inestimable value. Serial electrocardiograms, begun immediately at the time of the injury and thereafter, if negative will exclude a diagnosis of cardiac trauma. Positive graphs should demonstrate many alterations, as alterations of the T waves, of the S-T complexes, of the Q waves, of the rhythm as premature ventricular contractions, auricular flutter and fibrillation, ventricular tachycardia, etc. Positive serial graphs should demonstrate varying progressive changes in any or all of the complexes and rhythm.

Fluoroscopy is a distinct aid and proves of greater value than a teleoroentgenogram for in fluoroscopy the patient may be rotated completely, and a three dimensional picture visualized so as to enable the investigator to determine the enlargement of any chamber or the dilatation of any portion of the aorta.

Vital capacity examinations, through subjective responses, may prove of value, particularly so if investigated on several occasions. Decreased vital capacity is significant of myocardial impairment, provided pulmonary conditions are eliminated in the examination. Similarly effective are circulation rates and responses to exercise tests; blood studies for the significant rise and subsequent fall of the leucocytic count; temperature curves for their significant rise and fall—the higher and more prolonged, indicative of the more serious type of myocardial injury; erythrocytic sedimentation rates—the more rapid and the more lasting the more severe the injury; arterial tension—the more rapid the fall the more significant. Trauma, sufficient to injure the myocardium, of necessity, at the onset, decreases the vital capacity, increases the circulation

time, adversely affects normal responses to exercise, decreases the arterial tension, increases the sedimentation rate, increases the leucocyte count and alters the normal electrocardiograph. These changes are transient. It is to be emphasized again that greater reliance is to be placed upon results obtained from the purely objective types of examination rather than those in which the patient's cooperation is sought. Again, in the latter procedures patients may easily be guided in their responses. Careful observation and thorough investigations with repeated laboratory procedures will readily present sufficient positive evidence to warrant the diagnosis of cardiac trauma; and on the other hand, negative evidence can lead to but one conclusion—that of traumatic neurosis—"an emotional state of psychogenic origin which develops after an injury but is not related to any demonstrable structural pathology of the nervous system. In a clear cut neurosis the person has sustained no significant physical injury but has been only emotionally altered by traumatic experience" (19).

Traumatic neurosis is aggravated by many obvious factors, such as monetary loss in business activity, monetary gain if legal steps are contemplated, the effect upon the family of the injured, the delay in return to gainful occupation, etc.

Many psychic factors influence the course of this ailment, but it is safe to state that a well orientated normal individual does not develop a traumatic neurosis after minor injuries unless it be of some material advantage to him. Yet the average normal well integrated individual, subjected to severe and profound traumatic experiences, recovers from these injuries in a relatively short period of time without any neurotic after effects and manifestations. In addition, it is understandable that in questionable compensatory cases, it is but human to malinger and exaggerate. Thus the average man or woman in order to gain for themselves the highest compensation possible as a consequence of an alleged injury, or in order to utilize this episode as an escape mechanism from various personal or family difficulties, will surely dramatize and exaggerate, and oft times even malinger. These facts pertain to subjective and objective signs as well as the causal relationship between the alleged injury and the resultant condition. Our laboratory procedures as well as our clinical acumen should readily interpret these phenomena.

Preexisting heart disease, knowledge of its existence, its expected course, its complications, all play a significant rôle in determining the effect of socalled day by day trauma upon the chest wall. Witness the fact that innumerable people sustain trauma, of varying degree and nature, upon the chest wall and yet apparently maintain good health and a normal life expectancy. There are injuries which may aggravate or accelerate preexisting arteriosclerotic or valvular diseases of the heart. Yet, here, of necessity, there should be ample evidence of such disease in the records of the family physician or in the records of hospitals or clinics. These, then, would serve as an aid in the proper evaluation of the progressive nature of the accelerated heart disease due to the trauma. It is, however, in the cases where it is claimed there was no preexisting heart disease that it must be determined whether the trauma was responsible for the alleged heart ailment as volubly expressed by the patient in terms of pain, dyspnea and palpitation; and as equally volubly denied by the insurance carriers. The knowledge of the pathological condition of the heart and its natural course clearly should influence the investigator in his opinion as to whether the trauma plays a significant rôle, or whether trauma plays any rôle whatsoever.

There are definite "bridging symptoms" which furnish the physician with additional information in his quest to ascertain a definite causal relationship, especially so, in the aggravation of preexisting disease. Yet it is a truism that trauma may accentuate any type of preexisting cardiac disease. In heart ailments not preexisting, it is of utmost importance properly to evaluate all the criteria to determine the actual presence or absence of heart disease and to determine whether trauma was the etiological agent for the heart disease, and whether trauma caused its acceleration. Levy states that "trauma may cause myocardial lesions giving rise to 'coronary' electrocardiograms" (20); this, irrespective of the previous myocardial condition.

The question of causal relationship assumes a greater significance under the compensation acts. "The essential link of direct causal connection between the accidental personal injury and the employment must be established before the compensation act becomes operative" (21). This statement is equally applicable to injuries allegedly resulting from accidents, since not every injured person is entitled to compensation or recovery in negligence actions. The personal injury must, of necessity, be the immediate and essential inducing cause of the cardiac pathology and must singularly arise from the hazards of the employment or accident. It is true, to reiterate, that compensation or recovery may be awarded in cases of evident preexisting heart disease, providing that disease has been accelerated or aggravated by a specific trauma which was the proximate cause of death (Jakub vs: Ind. Comm., 288, 111, 87). Compensation, however, in cases of chronic heart disease where the heart condition has progressed to a degree that an exitus could be expected at any time from any type of exertion or merely at rest, will not be granted if death ensues during the course of his ordinary activities at his employment (Coe vs: Fife Coal Co., 2 B.W.C.C. 8). Similar reasoning must be accepted where there is no question of death but merely the presence and aggravation of preexisting heart disease.

Hyman (22) discusses three principal proximate causes for traumatizing the heart. The first is concerned with excitement and fright. Authorities have differed in the interpretation of excitement and fright causing traumatic heart disease; in one negligence case (Mitchel vs: Rochester Railways Co., 151 N. Y. 107) no award was recovered. Contrarily (Thompson vs: City of Binghamton, 218 N. Y. Supp. 355), an award was given since it was determined that an acute coronary closure occurred and death resulted as a consequence. In another case, an award was denied for it was determined that despite the occurrence of an acute coronary closure which resulted in death, the psychological factors precipitating the advent of the injury were neither unusual nor extraordinarily severe (O'Connel vs: Adirondack Elec. Power Corp., 185 N. Y. S. 455). There is a preponderance of medicolegal opinion, however, which states that only unusual stress,

strain, or emotional factors could result in cardiac injury—though, of the cases reported above, previous heart disease was present in all. Can it be determined whether or not this episode does occur in the nondiseased heart? Perhaps some of our cases may partly supply an answer. Hyman continues in the same vein and states that similar reasoning applies to overexertion and strain if unusual and extraordinary. But does this affect the socalled normal heart? He perhaps answers this question in his statement that the breathing of dust laden and impure air will definitely affect one with serious heart disease, but the effect upon the normal heart will produce nothing more than an accelerated heart action in addition to nausea, headaches and weakness.

Gray, influenced somewhat because of his singular experience (13), stated that "It is unreasonable to presume that the heart may be seriously jarred by a blow or fall, because it is suspended from its great blood vessels, hangs freely within its covering sac, and continually undergoes violent motion of its own throughout life". This statement is as readily applicable to the average injury sustained upon the chest wall, and it likewise is incumbent upon us to realize that the average blow or fall, as he states it, is understood as merely moderate trauma upon the chest wall. Gray claims that it "is not sound in theory or in practice" to promulgate the statement that lowered resistance following an injury further weakens an already damaged heart. In this regard the busy practitioner has repeatedly emphasized for him the fact that many people have a considerable heart involvement without any knowledge of it on their part. This statement has been all too clearly demonstrated in present and recent selective service medical examinations, in which the writer's experience confirms the conclusions of others in both local board and advisory boards, in which rejections because of heart disease ranked third to the eyes and teeth. In some twenty-five percent of those rejected because of this ailment, an unusually large proportion, perhaps some eighty percent were not cognizant of the fact that they were suffering from a disabling illness such as heart disease. And ranking first among the causes of rejection because of heart disease, was inactive rheumatic heart disease. It thus becomes readily appreciated, that the frequency with which murmurs discovered during routine examinations following accidents of any sort may be improperly associated therewith in the mind not only of the patient, the aggressive lawyer, but even the practitioner who lacks the experience gained through selective service physical examinations, which is so vital. And this, all the more so, since the selectees examined were indulging in athletics of all sorts in their preparatory schools where physical examinations were the rule.

The knowledge suddenly gained of heart disease in any of its manifestations, soon develops, for one reason or another, a train of symptoms which are either extremely exaggerated or were never present at all. This reasoning is particularly true when a murmur is discovered. Assuming utter sincerity upon the part of the examiner in his conclusions, it must be realized, as Connor so ably stated (24), "perhaps the commonest mistakes made in cardiac diagnosis are those due to misinterpretation of the significance of heart murmurs. By far the greater number of murmurs heard do not indicate valvular disease, and many of these have little or no clinical significance. It is, therefore, of great importance to be familiar with the features which distinguish murmurs due to valvular disease from the much more common type of 'functional' or 'accidental' murmurs." To this statement must be appended an additional thought, which is, that it is likewise of great importance to distinguish between murmurs associated with infective diseases, such as the diastolic apical murmur of rheumatism, and murmurs resulting from mechanical causes as evidenced in the vicious cycle of infarct, followed by aneurysm, dilatation, etc.

White and Glendy (25) further discuss the proper evaluation of trauma upon the heart and in the main they present principles for a more proper and adequate analysis:

(a) The effect upon the heart is in direct proportion to the severity of the injury upon the chest.
(b) The more diseased the heart, the more easily will it be injured by trauma.
(c) Irrespective of any actual damage to the heart, the number and severity of symptoms is dependent upon the nervous instability of the injured.
(d) To actually determine the severity and extent of probable myocardial injury, all possible methods of diagnosis must be utilized.
(e) The prognosis depends upon the extent of the cardiac damage, upon the extent of the preexisting heart disease, upon the complications, and upon the efficiency of therapy.

Yet these criteria do not apply to all injuries in which heart disease or its manifestations are discovered following an alleged injury, for it becomes readily evident that trauma does not cause such organic diseases of the heart as the rheumatic, luetic, hypertensive, or arteriosclerotic types; yet trauma as well as physical stress or strain of an appreciable nature may add an additional hazard to such preexisting disease.

Coronary artery disease resulting in thrombosis is a recognized entity of a gradual, progressive, degenerative disease; and there is no evidence to substantiate the oft expressed viewpoint within the legal field that trauma or even continued physical strain is the cause of these degenerative processes. Those engaged in laborious activities in middle life and those subjected to more frequent chest violence, as truckmen, subway riders etc., are less frequently affected by coronary artery disease and thrombosis than those who lead sedentary lives. The burden of exacting and complete subjective and objective manifestations must be accepted, however, to substantiate the diagnosis of an acute closure upon a diseased artery, especially so since the thrombosis does not form suddenly but does form gradually and the resultant symptoms are due not to the actual thrombosis but to the resultant localized anoxemia. It is, therefore, more reasonable to presume that continued undue stress or strain would, during its course, have initiated the thrombotic process, and the specific activity of the moment of the acute pain could not have served as the initiating agent unless it was a major vessel involvement. Again, the signs and symptoms are dependent upon the gravity of the situation, the size of the vessel involved, the extent of its disease, the rapidity of involvement, etc.

There are a sufficient number of cases reported and sufficient evidence is at hand to state that trauma may precipitate myocardial insufficiency even to the point of marked congestive heart failure, in an already diseased heart no matter what the etiology. The extent of the damage or failure is dependent upon a direct relationship between the severity of the trauma and the severity of the preexisting disease and its more possible complications. However, as yet, there has been no conclusive evidence presented in man, that ordinary trauma can cause myocardial insufficiency or acute dilatation of the heart as readily perceived by the daily trauma upon the chest walls of hosts of people in their daily routine. Severe, crushing injuries causing gross pathology and ultimate death are conceded the rôle of etiological agents in traumatic heart disease, and these will readily and easily evidence themselves in our laboratory. Abnormal cardiac rhythms may exist or develop but it is to be reiterated that these likewise do not necessarily indicate and are not synonymous with heart disease per se, or traumatic heart disease. Any injury to the heart, sufficient to be classified as an injury and not one within the realms of the imagination and sufficient to affect the heart so that the injured person becomes conscious of his heart in any fashion whatsoever, and sufficient to actually injure the heart structure, will be recognized in the laboratory!

(To be continued)

IMPORTANT CONSIDERATIONS IN MYOCARDIAL INFARCTION

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Myocardial infarction has been used interchangeably with the term coronary thrombosis. I do not believe it should. There are times when signs of myocardial infarction exist, and there is no confirmatory evidence of a thrombosis. An example of the latter is a coronary spasm. On the other hand, coronary thrombosis may be a cause of myocardial infarction, for the latter would be caused by a thrombus in a coronary vessel.

Etiology and Pathology

Many argue that sclerosis of the coronary vessels is the only cause. This brings us to a point which causes a great deal of controversy, especially in the industrial field where compensation is involved. For here the question is, can unusual effort or strain produce myocardial infarction? It is my opinion that it can and does.

Current theory has it that intramural hemorrhages may definitely occur in the arteries as a result of a severe blow on the chest or sudden rise in blood pressure, due to some unusual physical exertion or emotion. The amount of bleeding will determine the signs of infarction both clinically and from a laboratory viewpoint, i.e., the electrocardiogram, etc. If this is so, then why cannot the various excessive stresses or strains, which are suddenly placed upon the circulatory system, and which require a sudden increased amount of work and pressure to keep the different parts supplied with sufficient nourishment, be a cause of infarction? The mere fact that some individual happened to experience an attack of myocardial infarction while at rest, does not prove that one who had had an unusual exertive force placed upon his circulatory system, and suffered a similar attack, would have had it while at rest.

At this point, I should like to refer to the following writers who substantiate my view.

Dr. Boas (2), in a paper on "Cardiac Infarction induced by Unusual Effort", cites three such cases in which unusual effort was the etiological factor, and he goes on to say that these did not come within the compensation law or any other litigation.

The pathological studies of Horn and Finkelstein (4) revealed, by necropsy specimens in one hundred cases, that closure was produced by intramural hemorrhage in sixty-two and five-tenths percent of the cases. They also showed that intramural hemorrhage occurs in a vascularized section of an atherosclerotic area in the arterial wall. Intramural hemorrhage may be due to rupture of a capillary in the wall of a coronary vessel which in turn may be induced by several factors, such as a sudden rise in blood pressure, a severe blow on the chest, or a severe jar of the heart by *contre-coup*. The size and speed of the hemorrhage determines whether infarction will be immediate or delayed; thus coronary occlusion may be a slow progressive infarction.

Dr. G. Schwartz and Dr. Joseph Harvey (1), in one of their articles, present the case of a young man twenty-nine years of age, who developed a coronary closure following the throwing of a medicine ball rather vigorously. From all their studies on this case, they came to the conclusion that the unusual physical exertion of throwing a heavy ball had precipitated the coronary lesion.

One of the conclusions drawn by Dr. J. C. Paterson (3) from his cases studied in the Department of Pathology of the Ottawa (Canada) Civic Hospital, was as follows: "It is shown that increased intracapillary pressure, due to persistent hypertension, is a major factor in the formation of intimal hemorrhages and in the precipitation of coronary thrombi. As transient hypertension due to violent physical exertion or emotion will have a similar effect, these activities should be avoided by patients with coronary artery disease".

I should now like to cite two cases in which I was the attending physician. The first case was that of a man aged sixty, who, during the course of his work as a truckman, lifted a heavy crate and immediately collapsed. He was removed to a hospital where he refused to stay and went home. The diagnosis of an acute coronary thrombosis was confirmed by clinical evidence, the electrocardiogram, as well as blood and sedimentation tests. He was at bed rest for about eight weeks. A short time later he developed intraventricular block, followed by signs of a failing heart. About nine months after his coronary accident, he died suddenly while walking in the street. The autopsy did not reveal any etiology for this second episode.

The case was tried before the New York State Compensation Board, and the decision was rendered in

favor of the claimant. This proves that a definite causal relation had been established between the unusual effort of the lifting of the heavy crate and the coronary closure.

The second case was that of a young man, thirty-two years of age, who became involved in an argument with a co-worker regarding their work. This reached an exciting stage, and soon after the young man developed the signs and symptoms of a coronary closure. The diagnosis was confirmed by electrocardiogram and other laboratory procedures. This case is now pending before the New York State Compensation Board. I should like to say at this point that this patient recovered from the acute attack and is now back to work on his old job. Here, too, is a definite relationship between unusual excitement and emotion and the coronary accident.

Symptoms and Physical Findings

I shall not discuss in detail the symptoms and physical findings, as the average case is quite familiar to the practising physician. However, I should like to point out that the symptoms are not always marked by a great deal of pain, and there are times when the attacks are quite mild. In the latter, there may be only a small amount of discomfort and the patient may not even see a physician, only to find out at some future date, when an electrocardiogram has been taken, that there are signs of healed infarction. Attacks of sudden weakness or dizziness, plus a description of various sensations in the chest or epigastrium in an individual past the age of forty, who has always been in a state of good health, require a complete check up, including electrocardiogram, to rule out an acute coronary episode. Where there is doubt, it is better to have the patient rest in bed for several weeks under observation. In this way, the necessary precautions have been taken to safeguard the welfare of the patient.

Prognosis

The prognosis should be guarded. The mere fact that an individual suffers an acute coronary attack does not condemn him to immediate death. Various factors will influence the course of the disease. The attack may be due to spasm and this may be of varying duration. The size of the vessel occluded, whether it be a main vessel or a terminal branch, would determine the amount of myocardium affected and this, in turn, would influence the prognosis. When the septum has been affected and the conduction system interfered with, intraventricular heart block may ensue. Signs of heart failure may manifest themselves, thus complicating the picture and may alter the course of the disease. Finally, in all of these cases the nearest of kin should be advised of the seriousness of the disease.

Treatment

Once the diagnosis is made, it is important to relieve the patient of his pain and discomfort. He must be given rest and plenty of it. Opiates are the best drugs to be used during the acute phase. Repeat as often as necessary to obtain the needed rest and comfort of the patient. Then other drugs, which I shall speak of later, may be used. A nurse should be assigned to the case especially during the early acute phase, so that repeated hypodermic injections may be given when the attending physician is not available, and because someone is needed to see that the patient gets the required rest and quiet.

Absolute bed rest for a period of six to eight weeks is important. Avoidance of all strain is essential. Enemas should not be given for at least three days to avoid the strain of moving on to a bed pan, etc.

In the way of therapy, I have found that oxygen should be used immediately in the cases with terrific pain. It appears to help prevent the immediate formation of multiple thrombi, which, in these severe types of cases, are usually responsible for the death of the patient. Thus by giving oxygen immediately, not waiting for dyspnea or cyanosis to set in, we are doing a great deal towards prolonging the life of the patient. In the mild cases dyspnea or cyanosis may serve as a guide for the use of oxygen.

Among the drugs used, the most important are the vasodilators, antispasmodics and sedatives. A favorite combination is papaverine, one of the xanthine group, such as theobromine sodium salicylate, etc., an antispasmodic, and a sedative, preferably phenobarbital. Should any sign of heart failure appear, this must be treated accordingly.

The diet should be restricted and very light at the beginning. A Karell diet is often used but may be modified somewhat, depending on the severity of the condition. Less severe cases may have semisolid foods added about the fourth day. This should gradually be built up to an eight hundred calorie diet and the patient kept on this.

With the passage of time and favorable progress of the patient, the question of when to allow the patient to leave his bed arises. The electrocardiogram, the blood picture and sedimentation time should all be considered. Most important is the sedimentation time. The electrocardiogram may not return to normal for a long time but a sedimentation time will return to normal when the effects of the occlusion have worn off. Thus if a patient has had his required amount of bed rest and his blood count and sedimentation show no activity, he may be permitted out of bed even though his electrocardiogram has not returned completely to normal. Temperature will also be a guide to activity and as this decreases the temperature will drop. The patient should have a rest period of about two months after he has been permitted out of bed. He should be seen at regular intervals and complete check up examinations should be done. If any untoward signs are noted, such as beginning heart failure, he should be immediately treated for this.

Conclusion

In conclusion, I should like to reiterate briefly: 1. Unusual stress and strain should be considered as an etiological factor in myocardial infarction. 2. The symptoms will depend upon the pathology and this in turn will determine the severity of the case. 3. Coronary thrombosis does not necessarily result in immediate death. The patient may live for years after the acute closure. 4. Oxygen therapy should be instituted immediately in severe cases, regardless of the fact that the patient may not show cyanosis or dyspnea.

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PROTECTIVE ACTION OF EUTONON ON THE DIGITALIZED HEART

A Preliminary Report of Experiments on Frogs and Cats

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More than fifteen years of laboratory and clinical study have established that the cardiac hormone derived from liver, eutonon, has many properties and effects similar to those of digitalis. It has also been found that definite differences exist between these two substances. It is essentially a discussion of these differences and their therapeutic significance that forms the basis of this paper.

Before going into a consideration of the experiments on frogs and cats, it might be well to review briefly the data pertinent to eutonon[1] itself.

Extracted from the liver in 1927 (Zuelzer, 1), it has been found that eutonon is essentially a physiological substance produced by the liver and carried via the blood to the heart where it produces specific hormonal effects of great importance, thus fulfilling Starling's definition of a true hormone. The highly purified substance responsible for the specific hormonal effects does not contain the hematopoietic fraction of mammalian livers, is protein-free and free of protein split products such as alpha-amino acids or compounds containing alpha-amino groups. The ferric chloride tests for the presence of epinephrin-like substances is negative.

Histamine, choline and acetylcholine do not enter into the action of eutonon. Recent analysis by the highly sensitive method of Eggerth, Littwin and Deutsch (2), shows that the seven and one-half percent solution of eutonon used clinically contains less than seven and one-half gamma of histamine per cubic centimeter. Hence, in so far as action on the cardiovascular system is concerned, eutonon may be considered entirely free of histamine effects.

Other work (Salomon and Zuelzer, 3; Zuelzer, 4) has clearly demonstrated pharmacologically that the action of the heart hormone is quite different from that of either choline or acetylcholine. As a matter of fact, it has been found that the normal frog heart, poisoned and stopped by acetylcholine can be revived rapidly by direct application of one to three drops of a one percent solution of eutonon.

Pharmacological studies have established not only the hormonal action of eutonon but its physiological effects as well. Most pertinent are the investigations made with the Starling mammalian heart-lung preparation (Fisher, Müller and Zuelzer, 5; Zuelzer, 6, 7). In this procedure, the heart is isolated from all hormone-supplying sources but remains connected with the lungs. Physiological oxygen and carbon dioxide levels are maintained by suitable aeration while blood pressure, blood volume and pulse beat are readily regulated in a simple manner.

With such a preparation, lacking only normal hormonal supplies, it may be demonstrated that the heart gradually dilates while the coronary arteries become contracted despite the constant supply of blood being furnished. The result is a gradual failure of the organ with maximal dilatation. If, however, at this moment of maximal dilatation eutonon is injected into the blood stream, these results visibly begin to regress, followed by resumption of normal functioning of the heart and coronary vessels.

Repetition of these experiments proved that eutonon not only enhances the muscular activity of the heart, as was shown by reduction of systolic volume, but at the same time also increases coronary dilatation. In brief, the heart hormone serves to improve cardiac tonus and this effect is always associated with a pronounced coronary expansion. This point is particularly noteworthy, since such a combined effect is not obtained with drugs of an alkaloidal character such as digitalis.

These studies with the Starling heart preparation also demonstrated that, as a part of its function in maintaining cardiac tonus and coronary dilatation, the heart hormone is intimately concerned with the preservation of normal cardiac reserve. Other experiments, as well as numerous clinical studies and applications of eutonon, have since verified this hormonal effect and substantiated the hormonal concept.

Effects of Digitalis and Eutonon

From these investigations it became quite evident that the effect of eutonon on heart muscle tonus closely parallels that of digitalis. In this connection, it must be remembered that the myocardial action is considered to be the most important pharmacodynamic effect of digitalis (Goodman and Gilman, 8).

It was also quite evident that certain important differences exist between the heart hormone and the cardiac drug. The most outstanding of these was the observation that, at the same time eutonon produces an increase in myocardial tonicity, it likewise causes a dilatation of the coronary vessels, which effect is lacking with digitalis.

Although it is conceded that divergent views exist concerning the effect of digitalis on coronary blood flow, there is considerable evidence to show that vasoconstriction occurs with digitalis therapy (Gilbert and Fenn, 9). Indeed, Bastedo (10) states quite definitely that "*constriction of the coronary arteries* is a real digitalis effect." In his opinion, coronary con-

[1]Eutonon is a seven and one-half percent solution of special extract of deproteinized liver processed with two and one-half percent dextrose, available in one cc. ampoules and ten cc. rubber capped vials. The eutonon used in these experiments was manufactured and supplied by Anglo-French Laboratories, Inc., 75 Varick Street, New York City.

striction may be a factor in weakening the muscle in cases of acute poisoning, while in cumulative poisoning it may be the cause of the condition known as *pulsus alternans*.

Another important difference is the wide margin of safety inherent in eutonon. Recent toxicity tests showed that a man-frog equivalent of thirty-seven cc. and a man-rabbit equivalent of forty-seven cc. of eutonon (same strength used clinically in ampoules) were well tolerated, the figures being transposed on the basis of a seventy kilogram man. Since the therapeutic dose is far below these levels, it is quite obvious that the heart hormone is safe for therapeutic administration.

Eutonon does not possess cumulative properties as do digitalis drugs and overdosages of the heart hormone do not appear to be associated with any disturbing effects. Significant in this respect is Lange's (11) observation that the harmless character of eutonon is always emphasized by those who have employed it therapeutically.

In the case of digitalis, although the therapeutic dose represents about one-third of the fatal dose, the full therapeutic effect practically coincides with the minor toxic manifestations (Sollmann, 12). Goodman and Gilman (8) are of the opinion that a "nontoxic" digitalis does not exist and that a preparation which will not cause digitalis poisoning when given in excess is also one that will be ineffective therapeutically.

Again, eutonon does not appear to affect the central nervous system as does the administration of digitalis in many cases. Hence, the patient on eutonon therapy is spared the untoward effects associated with digitalis medication. This is but to be expected of a natural product of physiological origin whose effects are directly associated with the action of a specific organ.

Eutonon exerts no direct diuretic action, a known effect of digitalis. This may or may not be an advantage. In the treatment of cardiac edema, for example, it has sometimes been found advantageous to administer a diuretic in the early stages of therapy with the cardiac hormone preparation. However, one must not overlook the fact that there are many instances where the diuretic action of digitalis is neither very effective nor very desirable (Cushny, 13). Indeed, in a large proportion of patients with congestive heart failure, additional and specific diuretic measures are required (Goodman and Gilman, 8).

A consideration of these facts, both the similarities and especially the differences of effect, definitely suggested that the concurrent use of eutonon with digitalis should have beneficial results under certain conditions. It was largely from this viewpoint that the laboratory investigations to be here reported were undertaken.

Amphibian Heart Studies

The combined action was tested on both amphibian (frog) hearts and upon mammalian (cat) hearts. The purpose of the first series of experiments was to determine the action of eutonon on the frog heart after the use of digitalis. It was felt that this series would also give indicative information regarding the experiments on the cat heart.

The technique used was that outlined in the U. S. P. XI for the standardization of digitalis, the only modification in the procedure being the method of using eutonon as shown in Table I. This table likewise summarizes the data obtained in this experiment.

These data show that, in frogs injected with one U. S. P. XI unit of digitalis, injections of eutonon (one percent solution) at the time of digitalization or subsequent direct application to the amphibian heart delayed the time of death in systolic standstill. This delaying effect was not proportional to the eutonon dosage. However, it must be remembered that the U. S. P. XI method for standardizing digitalis, used in this study, allows for many variables any one of which may have been a factor in the disproportionate effects of eutonon.

The experiments described above were amplified in order to determine to what extent greater concentrations of eutonon given before, at the time of and after digitalization will delay the time of death in systolic standstill.

Table I: Effect of Eutonon after Digitalis on Time of Death of Frog's Heart

FROG NO.	AMOUNT OF DIGITALIS	AMOUNT OF EUTONON INJECTED INTRAMUSCULARLY AT TIME OF DIGITALIZATION	DIRECT APPLICATION TO HEART	TIME OF DEATH (SYSTOLIC STANDSTILL)
27	1 U.S.P. unit	—	—	61 min.
28	1 U.S.P. unit	—	—	61 min.
29	1 U.S.P. unit	—	—	60 min.
30	1 U.S.P. unit	—	—	61 min.
31	1 U.S.P. unit	1 cc.	—	69 min.
32	1 U.S.P. unit	2 cc.	—	61 min.
33	1 U.S.P. unit	3 cc.	—	65 min.
34	1 U.S.P. unit	—	10 minims	68 min.
35	1 U.S.P. unit	—	10 minims	74 min.

U. S. P. XI assay method of digitalis experiments were followed throughout. In the first group of frogs one cc. of five percent solution of eutonon powder was injected intramuscularly at the time of digitalization (for clinical use, eutonon is supplied in ampoules containing seven and one-half percent solution of eutonon powder). In group II, one cc. eutonon ten percent was injected intramuscularly five minutes before digitalization. In group III, the animals received one cc. of ten percent eutonon intramuscularly fifty-five minutes after digitalization, which is five minutes before the expected death in systolic standstill. In group IV, four applications of five drops of eutonon ten percent at fifty-five, fifty-seven, fifty-nine and sixty-one minutes after digitalization were made directly to the heart.

Control animals were used for all these studies. In group IV, saline applications were made in the control animals. (Table II)

Time of death of frog heart in systolic standstill of animals receiving eutonon intramuscularly in group I averaged sixty-two and one-third minutes, controls averaged sixty minutes; in group II those receiving eutonon by intramuscular injection averaged sixty-seven minutes, controls averaged sixty-three minutes; in group III those receiving eutonon (intramuscularly) averaged sixty-eight minutes, controls sixty-four and two-thirds minutes; in group IV the frogs receiving eutonon by direct application averaged eighty-three minutes, controls sixty and two-thirds minutes.

Summarizing the frog experiments to determine the influence of eutonon on digitalization, it was found that direct application of eutonon solutions to frog hearts

Table II: Effect of Eutonon with Digitalis on Time of Death of Frog's Heart

FROG NO.	WEIGHT (GM.)	TIME OF DEATH (SYSTOLIC STANDSTILL)
I. Received one cc. of five percent solution of eutonon powder by intramuscular injection immediately before digitalization.		
1	20	58 minutes
2	24	59 "
3	22	70 "
Controls		
4	19	60 "
5	26	60 "
6	24	60 "
II. Received one cc. eutonon ten percent by intramuscular injection five minutes before digitalization.		
7	23	65 "
8	27	62 "
9	24	74 "
Controls		
10	24	62 "
11	26	65 "
12	25	62 "
III. Received one cc. eutonon ten percent by intramuscular injection fifty-five minutes after digitalization.		
13	24	75 "
14	27	60 "
15	30	69 "
Controls		
16	28	70 "
17	23	62 "
18	31	62 "
IV. Received by direct application to heart five drops eutonon ten percent at fifty-five, fifty-seven, fifty-nine and sixty-one minutes after digitalization.		
19	31	78 "
20	28	81 "
21	29	90 "
Controls		
22	32	60 "
23	22	62 "
24	27	60 "

after digitalization delays the time of death in systolic standstill just enough to show that there is some stimulating influence of the hormone. Intramuscular injections of eutonon solutions before, at the time of and after digitalization likewise delay the time of death in systolic standstill but to less extent than direct application of eutonon after digitalization.

It must be admitted that these are preliminary experiments undertaken in order to determine the antagonistic and protagonistic effects of the heart-hormone and the heart-drug. Having already determined in cats that cardiac death caused by digitalis can sometimes be avoided completely by use of small doses of the heart-hormone, further experiments are contemplated to ascertain the degree of protection possible with much larger doses.

Intravenous Cat Method

With these significant findings as a basis, it was decided to determine experimentally the value of eutonon as a protective against fatal doses of digitalis, using cats as test animals. Essentially, the procedure aimed at determining the effectiveness of eutonon injections to avoid or delay death of cats in ventricular fibrillation following the injection of a known lethal dose of a recognized digitalis preparation (digalen injectable, Roche) previously assayed in terms of cat digitalis units.

The eutonon preparation used in these experiments was the same as that supplied for clinical administration; *e.g.*, seven and one-half percent of the highly purified material in two and one-half percent dextrose solution.

The method employed was adapted with slight modifications from the intravenous cat method of digitalis assay described by Gold, Cattell, Kwit and Kramer (14). The principal modification was the use of barbital intraperitoneally in the standard dose for cats as a partial substitute for light ether anesthesia. With barbital the animals were kept under light anesthesia for two or three hours.

Cats weighing between 2.0 and 3.5 kg. and free from gross evidence of disease were selected. No obese, emaciated, lactating or pregnant cats were used. Animals received no food for sixteen to twenty-eight hours before testing. All cats were assigned to five groups so that the average weight of any group did not vary to any marked extent.

Ten minutes before beginning anesthesia with ether, three percent barbituric acid in twenty percent alcoholic solution on the basis of one and one-half cc. per kilo animal weight was injected intraperitoneally. After waiting ten minutes light ether anesthesia was begun. This was maintained throughout so that, while pain was absent, pupillary and corneal reflexes were present. The voluntary musculature was not relaxed and the cat occasionally moved its tail.

A cannula was inserted into the femoral vein and the test dilution of the digitalis preparation injected from a burette calibrated to 0.1 cc., after insuring absence of air bubbles from the injection apparatus.

Each two cc. (one cat unit) of the standard preparation (digitalis) was diluted to eight cc. and injected at the rate of one cc. per kilo every ten minutes until the cat died in ventricular fibrillation.

The first group of cats was injected with digitalis preparation according to the above procedure in order to establish standardization under the existing laboratory conditions. The results are listed in Table III.

Table III: Time Necessary to Produce Death in Cats in Ventricular Fibrillation with Digalen Injectable "Roche"

CAT NO.	WEIGHT (KG.)	TIME OF DEATH (MINUTES)
1	2.4	78
2	2.8	75
3	2.7	74
4	2.9	70
5	3.0	63
Average	2.76	72

For the purpose of further testing and as a basis of comparison, a standard digitalization time of seventy-two minutes was arrived at from this experiment as being the cat unit to be used under the existing laboratory conditions. Thus an average of eight injections at ten minute intervals, including the initial injection, was administered to induce digitalis death. Each injection provided one-eighth digitalis cat unit.

Following the same technique for digitalization (injections of one-eighth cat digitalis unit doses at ten minute intervals), cats of groups II, III, IV and V were given the digitalis preparation and eutonon.

The amount of eutonon given each cat was based

upon the human therapeutic dose (two cc. for a man weighing 150 pounds), but ten times the comparable amount per kilo animal weight (approximately 0.4 cc.) was used.

With reference to the amount of eutonon administered to the cats, it should be stated that the clinical dose of two cc. is recommended for very slight cases where considerable heart troubles do not exist; i.e., when there is only a slight lack of the heart hormone. The principal difference in dosage between the drug digitalis and the hormone eutonon is that the dose of the latter must be based upon the degree of hormone deficiency as in the case of insulin, while digitalis has a standardized therapeutic dosage.

Eutonon was given intravenously in one injection twenty minutes previous to starting digitalization in the animals of group II, twenty minutes after starting digitalization in group III and immediately preceding digitalization in group IV.

As cats of group IV reacted most favorably to the action of eutonon, group V was a repeat experiment to recheck and corroborate these findings. The results of these experiments are summarized in Table IV.

From Table IV it may be noted that cats in group II showed an average time of death of seventy-seven and two-thirds minutes with an average of 1.06 cat digitalis units per kilo and group III seventy-eight and three-fourths minutes with an average of 1.03 cat digitalis units per kilo.

In group IV and again in group V, the results produced were of marked significance. Cats in group IV showed an average survival time of 88.17+ minutes (statistical maximum on basis of longest survival time of any animal under comparable conditions, allowing for full survival of one animal) with an average of 1.14 cat digitalis units per kilo, while cats in group V displayed an average survival time of 87.8 minutes with an average of 1.13 cat digitalis units per kilo.

Thus two groups of cats given eutonon immediately preceding digitalization survived on an average, respectively, 16.2+ and 15.8 minutes longer than the standardization animals.

The effective action of eutonon on digitalized animals was demonstrated by the fact that several of the cats were enabled to survive long enough to receive added injections beyond those given the standardization cats. Thus, cat No. 19 received two injections beyond the usual fatal dose of the digitalis preparation (as established by standardization) and cats No. 20, 21, 25 and 26 received three extra doses. Even under these severe conditions cat No. 20 in group IV did not die and cat No. 25 of group V lived 125 minutes. The digitalis was administered at ten minute intervals up to one hundred minutes only.

It is quite probable that, had these animals been given only the established fatal dose of the digitalis preparation (*e.g.*, eight injections or one cat unit), their survival time would have been greatly extended. It is our aim in further studies to determine, if possible, a ratio between the digitalis and eutonon dosages which will insure survival of all the digitalized animals as in the case of cat No. 20. The close agreement between the two groups IV and V clearly indicates the high degree of accuracy of the procedure.

Autopsy was performed on one cat from each group (cats No. 10, 15, 20, 25). Cat No. 20 was killed three hours after digitalization. The heart was in fairly good condition, there being only slight relaxation of the muscle. This was in contrast to the extreme flaccidity of the heart muscle of the other cats.

To summarize the intravenous cat experiments, eutonon in an amount comparable to ten times the human therapeutic dose based on animal weight, given immediately preceding digitalization, prolonged the time of death considerably: 16.2+ minutes in one group and 15.8 minutes in another, an average of 16+ minutes for all animals tested. In one instance, such eutonon administration averted death even after thirty-seven and one-half percent more than the established fatal dosage of digitalis given.

Table IV: Effect of Eutonon with Digitalis on Time of Cat Death

CAT NO.	WEIGHT (KG.)	CAT DIGITALIS UNITS GIVEN PER KILO	TIME OF DEATH (MINUTES)
II. Eutonon administered twenty minutes previous to digitalization.			
6	2.3	1⅛	80
7	2.4	⅞	65
8	2.5	1	72
9	2.1	1⅛	80
10	2.6	1¼	90*
11	2.9	1	79
Average	2.46	1.06	77-2/3
III. Eutonon administered twenty minutes after digitalization was started.			
12	2.9	1	73
13	2.1	1	79
14	2.5	1	79
15	2.4	1⅛	84*
Average	2.47	1.03	78-3/4
IV. Eutonon administered immediately preceding digitalization.			
16	3.1	1	75
17	2.9	⅞	65
18	2.8	1	74
19	3.0	1¼	90
20	3.4	1⅜	125+** (no death)*
21	2.8	1⅜	100
Average	3.0	1.14	88.17+
V. Eutonon administered immediately preceding digitalization.			
22	2.1	1	71
23	2.9	⅞	68
24	2.1	1	75
25	2.4	1⅜	125*
26	2.1	1⅜	100
Average	2.32	1.13	87.8

*Autopsied.
**Statistical Maximum.

These results show that eutonon in adequate doses has a definite protective action against digitalis when the administration of eutonon and the beginning of digitalization coincide. They also indicate that these experiments may eventuate in the establishment of definite unitage for the administration of eutonon, basing the unit upon survival of the animal after injection of one cat unit of digitalis. Further pharmacological experiments with this object in view are contemplated.

Clinical Deductions

The results of these experiments upon the frog heart, and especially the cat heart, would strongly suggest that the concurrent use of eutonon and digitalis would

be most desirable in clinical practice particularly in acute stages and during the first phases of digitalization. The dilative action of eutonon on the coronary arteries would definitely tend to lessen or even overcome the constricting effect of digitalis. The similarity of effects on myocardial tonus and cardiac volume would obviously decrease the amount of digitalis required to produce therapeutic effect. Hence, many of the untoward, toxic effects of digitalis therapy could be avoided or eliminated entirely.

However, these suggestions and observations are not based solely on deductions from the results of the pharmacological studies herein reported but upon clinical observations as well (Zuelzer, 15). Indeed it might be said that these animal experiments have served to confirm clinical findings in exact pharmacological terms.

It has been found that the dose of digitalis is preferably kept low so that its vasoconstrictor effect will not interfere with the vasodilative effect of eutonon. This is especially true in cases of cardiac asthma, with or without lung edema. The vasodilative effect of eutonon has proved particularly valuable in the therapy of angina pectoris, a condition associated with spasm of the coronary arteries and failure of the heart muscle (Salomon and Zuelzer, 3; Zuelzer, 4, 6, 7, 16; Schottmüller, 17; Steuer, 18). In the great majority of these cases of angina pectoris, however, it was the use of eutonon alone that gave the most effective results.

Conclusions

The pharmacological and physiological basis for the action of eutonon, the cardiac hormone, has been briefly reviewed. A detailed report of experiments on digitalized frogs and cats has been presented, which clearly indicates that eutonon has a protective action on the digitalized heart when the two substances are administered concurrently. The clinical applicability of this information has been indicated.

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THE STETHOGRAM IN PRACTICE*

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The phonocardiograph is an instrument for the production of heart sound records. Just as the electrocardiograph visualizes the differences in electrical potential occurring during the cardiac cycle, the phonocardiograph visualizes the phonetic changes occurring during the cardiac cycle.

In 1819, Laennec (1) wrote his *Treatise on Mediate Auscultation.* It is interesting to read in the author's own words how his discovery came to him.

"In 1816, I was consulted by a young woman labouring under the general symptoms of a diseased heart, and in whose case percussion and the application of the hand were of little avail on account of the great degree of fatness. The other method just mentioned being inadmissible by the age and sex of the patient, I happened to recollect a simple and well-known fact in acoustics, and fancied at the same time, that it might be turned to some use on the present occasion. The fact I allude to is the augmented impression of sound when conveyed through certain solid bodies, as when we hear the scratch of a pin at one end of a piece of wood, on applying our ear to the other. Immediately, on this suggestion, I rolled a quire of paper into a sort of cylinder and applied one end of it to the region of the heart and the other to my ear, and was not a little surprised and pleased, to find that I could thereby perceive the action of the heart in a manner much more clear and distinct than I had ever been able to do by the immediate application of the ear. From this moment I imagined that the circumstance might furnish means for enabling us to ascertain the character, not only of the action of the heart, but of every species of sound produced by the motion of all the thoracic viscera."

*From the Department of Cardiology, Beth-El Hospital, Brooklyn. Read before the Brooklyn Society of Internal Medicine, May 1941.

With our modern stethoscope, it is quite true that the action of the heart is heard in a manner clear and distinct, but much confusion still exists in the interpretation of the sounds elicited and their evaluation. A review of the medical charts in any hospital will demonstrate that clinicians differ widely in their notations of cardiac auscultatory findings. The reason for this discrepancy resides in the fact that there are differences in the individual threshold of audibility. The human ear has numerous inherent shortcomings of hearing with marked personal variations. Many physicians, under the impression that their hearing is normal, would be surprised to find pronounced peaks and valleys in their range of hearing, if their audiograms were charted. Furthermore, the valleys of hearing-range would be found to fall well below the threshold of hearing for some of the important heart sounds. Wiggers (2) has pointed out that most of the vibrations of the chest wall produced by the heart, have an amplitude and frequency which approach the lower auditory limit, and that some of these vibrations are incapable of being recognized at all. The average ear and brain have no little difficulty in differentiating the finer alterations in time, frequency and form that are shown so clearly to exist when graphic records are made. In addition to the normal faults of the human ear and the individual variations, hearing defects tend to become more pronounced as the physician becomes older, with the result that certain sounds are inaudible to the doctor without his being aware of the fact. Such defects may be overcome by supplementing ordinary auscultation with graphic recording.

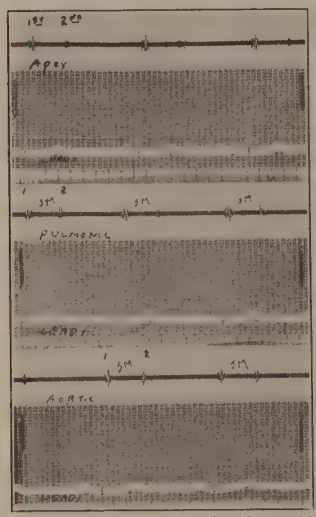

FIG. 1.—Stethogram synchronized with electrocardiogram of a normal heart. The first heart sound, S_1, occurs .04 seconds from beginning of QRS complex. The second heart sound, S_2, occurs .38 seconds from beginning of QRS complex of the electrocardiogram.

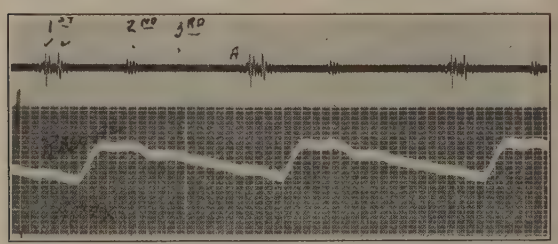

FIG. 2.—Stethogram synchronized with radial pulse tracing, showing the first, second, third, and fourth heart sounds. The first sound shows splitting. The fourth heart sound, A, precedes the first heart sound.

Sound is a form of energy resulting from the vibration of a medium and its ability to travel through matter depends upon the elasticity, viscosity, and density of the medium. Different media will transmit sound frequencies with varying fidelity. When sound travels from one medium to another of different physical properties, modification of the sound takes place. A large percentage of the cardiac sounds never reach the surface because of changes in density, spreading, reflection and refraction losses (3).

Let us review briefly the subject of sound as related to the heart. Sound has three definite characteristics: pitch, intensity, and quality or tone. Pitch is determined by the frequency of oscillation; intensity depends upon the amplitude of the vibrations; quality is associated with the superimposed harmonics upon the fundamental tone. Heart sounds are not distinct musical notes, but consist of a mixture of discordant vibrations, and should be termed, more correctly, as noises, the dominant frequency determining the pitch. The entire frequency band for heart sounds and murmurs lies below a thousand cycles per second, the lowest frequency reaching five or ten cycles. This is of great significance, since the lower limit of audibility is around thirty to forty cycles per second, a fact which explains our inability to hear the third or fourth heart sounds.

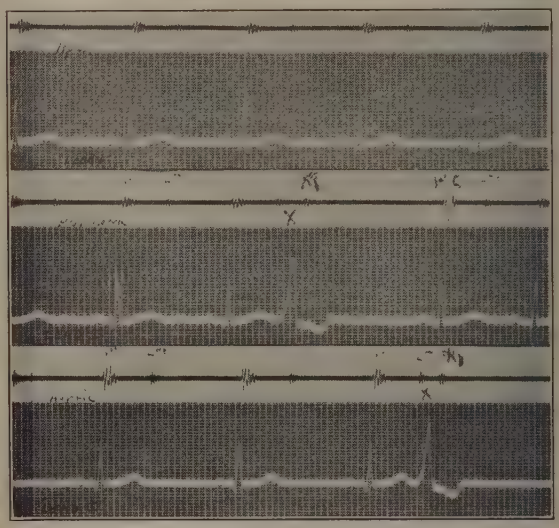

FIG. 3.—Stethogram synchronized with electrocardiogram. The ventricular premature beat, X, has only a first sound, X_1. There is no second sound for the premature beat. The first sound of the normal beat, 1st C, following the compensatory pause, shows increased loudness.

Williams and Dodge (4) have shown that most heart sounds and murmurs fall within a narrow frequency band of fifty to five hundred cycles per second, a factor of fundamental importance in the construction of clinically useful sound-recording devices. At the present time, there are several satisfactory machines on the market, making use of electronic tubes and selective crystal microphones, which yield fairly clear records.

The heart sound record, or stethogram, is an invaluable aid in diagnosis. It reveals the character of the cardiac sounds and produces a permanent record for filing and comparison. It presents a graphic analysis of cardiac murmurs with respect to the point of maximum intensity, the time and duration of their occurrence, their pitch and loudness, including crescendo and decrescendo effects. Obviously, such information is of material assistance to the clinician. It is objective, and is not subject to the many variables encountered in clinical observation. We have already seen that clinical findings vary with the personal equation, the

acuity of hearing and the experience of the physician. The stethogram eliminates the personal factor. It may disclose murmurs which are missed by the clinician. It

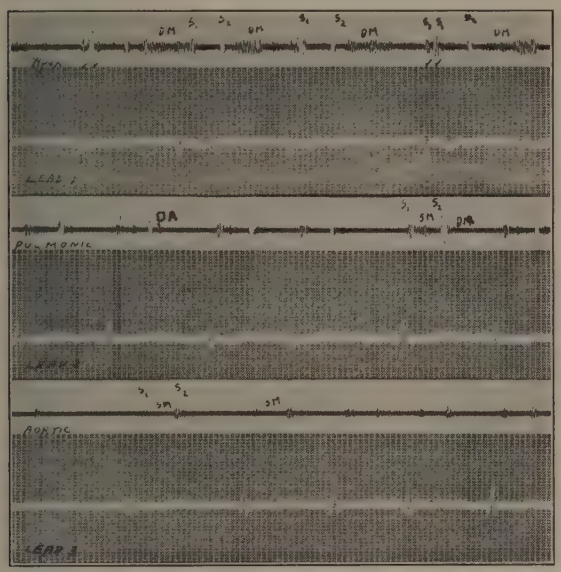

FIG. 5.—Stethogram synchronized with electrocardiogram. A case of chronic valvular heart disease with auricular fibrillation. S_1, first heart sound; S_1S_1, splitting of first heart sound; S_2, second heart sound; SM, mitral systolic murmur; DM, mitral diastolic murmur; DA, aortic diastolic murmur. In the apex record, there is a clear silent interval between the second sound, S_2, and the mitral diastolic murmur, DM.

demonstrates third and fourth heart sounds, and the splitting of normal heart sounds. It can make clear the point of origin of loud widely transmitted murmurs. Attempts have been made to differentiate functional (Fig. 4) from organic murmurs by means of the stethogram, using the number of vibrations as a criterion (5).

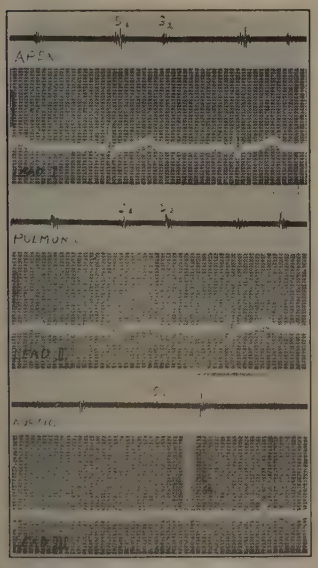

FIG. 4.—Stethogram synchronized with electrocardiogram. A functional systolic murmur, SM, localized at the base of the heart is heard best over the pulmonic and aortic areas.

The objective, graphic method of heart sound investigation has already uncovered a number of interesting problems. Textbooks of physiology describe the first heart sound as consisting of a muscular and valvular content, while the second heart sound is purely valvular in origin. The genesis of the first sound, in so far as the muscular element is concerned, has been disproved by Dock (6), who showed that the contracting empty heart does not emit a sound. In like manner, Steed and Kunkel (7) demonstrated that the auricular, or fourth heart sound, is not due to the contraction of the auricular musculature. In fact, all the heart sounds are the result of valvular vibrations or tensions set up in the valves, chorda tendinæ or muscle. Stethograms also reveal the remarkable frequency of the third and fourth heart sounds, demonstrating beyond question, faults in our auditory apparatus. Various forms of gallop rhythm, the splitting of the first and second heart sounds, not detected by the ear, are clearly visualized in the graphs (Fig. 2).

The stethogram has also exposed the unreliability of murmurs in the diagnosis of heart disease by demonstrating their frequency in healthy individuals. This is especially true of systolic murmurs (Fig. 4). Fine diastolic murmurs, inaudible to the ear, are sometimes visualized in the tracings of normal hearts. It is possible that a certain amount of aortic regurgitation is present normally, due to the failure of the aortic cusps to close

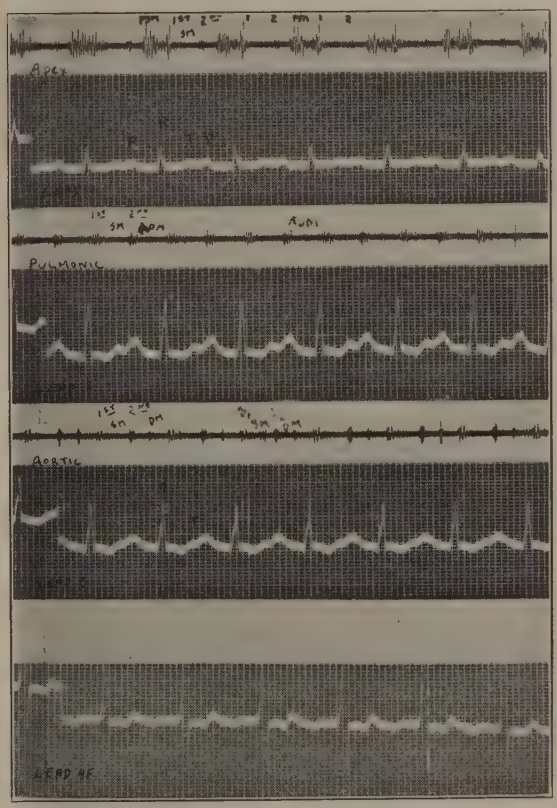

FIG. 6.—Stethogram synchronized with electrocardiogram. A case of chronic valvular heart disease during a recurrent attack. S_1, first heart sound; S_2, second heart sound; SM, systolic murmur, PSM, presystolic murmur; ADM, aortic diastolic murmur. The prolonged P-R interval causes the presystolic murmur of the auricular systole to appear diastolic in time.

tightly, and that the organic murmur of aortic regurgitation is only a matter of degree. McKee (8) examined one hundred normal children between the ages of five and fifteen. She found a splitting of the first sound in twenty-three percent, a splitting of the second sound in fifty percent, and a splitting of both sounds in fourteen percent. Siemsen (9) studied a group of boys ranging in age from five to eighteen years, and found split heart sounds to be a common occurrence.

The stethogram has also provided a means for the

study of the third and fourth heart sounds. In a group of children, where the third heart sound was audible in six percent of the cases, McKee (8) found the third heart sound clearly visualized in sixty-six percent, in the graphic apical tracing. Thayer (10) observed that the third heart sound is best heard with the patient lying on his left side. Wolferth and Margolies (11) showed that the third heart sound coincided with the final third of the v wave in the phlebogram, that is, with the period of rapid ventricular filling. McKee (8) recorded fourth heart sounds in ninety-four percent of her group of normal children. The fourth heart sound is best seen in cases of heart block. It consists of two components (11). The first portion is transmitted to the esophagus and corresponds to the height of auricular systole. The second component is best heard over the precordium and forms the initial vibration of the first heart sound. It is interesting to note, in passing, that the interval between the second and third heart sound is relatively constant, and is not affected by changes in rate due to respiration or exercise. The interval between the third and the fourth heart sound does show alteration with changes in rate. This interval is analogous to the T-P period in the electrocardiogram, demonstrating that diastolic shortening is the primary factor in rate increase, and only in the higher rates, a contraction of the systolic interval is to be found.

Increase in the heart rate augments the intensity of the first heart sound sometimes as much as five hundred percent. Steed and Kunkel (7) have offered an ingenious explanation for this phenomenon. They agree with Dock, that the first sound is valvular in character, and that modification of the first heart sound takes place by alterations in the tension of mitral and tricuspid valves. During tachycardia, diastole is short and ventricular filling is incomplete. The valves are lax and floating in the ventricular cavities when the systole of the ventricles forcibly throws them into a state of closure, thereby producing a loud sound. Another factor which contributes to the loudness of the first sound, is the systole of the auricles. When the P-R interval is normal, the auricular systole tends to displace the valves toward the ventricular chambers, thus slackening their tension. The relaxed valves are then closed forcibly, thus augmenting the quality of the first sound. The authors conclude that a well-filled ventricle does not produce a loud sound, just as a well-filled barrel tends to deaden all sound. Wiggers (2) believes that the intensity of the first heart sound is proportional to the systolic tension developed in the ventricles, whereas Wolferth and Margolies (14) contend that the loudness of the first sound depends upon the rapidity of rise of the intraventricular tension. However, a careful survey of synchronized graphs shows that the major portion of the first sound is apparent before the semilunar valves have opened.

Aortic diastolic murmurs are notorious for the ease with which they escape detection. The large pulse pressure, frequently with a diastolic pressure of 0, and the heaving apex beat of an enlarged left ventricle are clinical evidence that aortic regurgitation is present, but the soft sighing character of the murmur, aptly termed "the silent diastolic murmur of aortic regurgitation", oftentimes eludes the wary practitioner. The following two cases illustrate the presence of the silent aortic diastolic murmur.

The first case concerns a girl of twenty-three, who has had chronic valvular heart disease for sixteen years, with auricular fibrillation for five years. Her blood pressure was approximately 120-40. A systolic and diastolic murmur was heard at the apex, a systolic murmur at the aortic area. The stethogram revealed the presence of an aortic diastolic murmur immediately following the completion of the second heart sound (Fig. 5). The second case is one of advanced rheumatic heart disease during a recurrent attack. The hospital record shows that the resident physician did not hear the aortic diastolic murmur which is clearly seen following the second sound in the stethogram (Fig. 6). This close connection between the second heart sound and the aortic diastolic murmur is the distinguishing characteristic of the murmur in contrast to the mitral diastolic murmur, which always presents a silent interval between the second heart sound and the mitral diastolic murmur.

Conclusions

1. The stethogram is objective and it eliminates the personal equation.
2. The stethogram presents an accurate analysis of cardiac sounds and murmurs, their site of origin, timing and duration.
3. The stethogram permits a detailed study of the heart sounds and cardiac murmurs, making clear their character for differential diagnosis.
4. The stethogram furnishes a permanent record for filing and comparison.

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A POPULAR ESSAY ON AIR

SMITH ELY JELLIFFE
New York, N. Y.

(*Concluded from page* 419)

Nothing which was once part of a living thing, either plant or animal, can lose its wellspring of life without undergoing decay, unless it is completely shut off from contact with air, which means from contact with the particles that float in the air. There is an invisible Prince of the Power of the Air that is the attendant of both Death and Life. Where death comes he takes his prey, and separating it into its elements, returns it to the earth so that life may again use the old materials for new beings. This power has been known to the scientific world for the last twenty years as the germ. Since the dawn of life the germ has silently done its work, converting forests into soil, and returning the bodies of man to the dust, but it has only recently been discovered and called by as many names as it has kinds, and with this discovery has come the possibility of battling with it when it proposes too peremptorily to destroy life, and, to cultivate it when its subtle transformations are of benefit.

Broadly speaking the germs of the air may be either moulds or bacteria. Both are parasitic fungi because they draw their nourishment from organic substances. If the air can get into a jar of preserves by the smallest crevice, the minute spores of some mould will surely float in and start to grow, producing a fine filmy down covered with the pink or green powder of countless spores; cheese that is exposed to air in a damp place becomes covered with moulds whose spores have settled at random from the air. These are light and invisible and always form a large part of the "sun dust." They love moist places that are not too cold, and their presence in the air is a sign of the lurking damp in walls that affords them a congenial soil.

The spores of these moulds are in themselves perfectly harmless and in some cases are of priceless value. Yeast is one of them, and although it must have been selected from all other air fungi and cultivated long before the hard heart of Pharaoh drove the Israelites from the land of the Egyptians and their leavened bread, it was not known until fifty years ago that it was a minute one-celled plant, that lived and grew in certain foods by budding, and could reproduce itself millions of times in the course of a few hours. The greater proportion of the germs in the air are the spores of moulds. It has been counted that there may be anywhere from four to forty floating in every cubic foot of out door air.

The bacteria of the air, although the smallest of all living organisms, are of perhaps the greatest interest to the layman as well as the scientist. If they were counted as individuals, they would far out number the moulds in the air, for they are as numerous as the stars in the Milky Way. But they are generally found clinging together in masses on shreds of wool, and cotton, and particles of the coarser dust of the air which, when the air is quiet, fall to the ground. Therefore there are not nearly as many bacteria in the air as there are moulds; except when the dust to which they are attached is stirred up. It is for this reason that sanitarians advocate the abolition of carpets and hangings in sleeping rooms and in hospitals.

A glass tube filled with gelatine or beef tea, if set in the air for a few days will become cloudy or streaked, or have peculiar little spots or blotches in it, due to the presence of what is technically called a colony of bacteria, that have sprung from one or several attached to some particle of dust that has fallen on the surface of the liquid. A very high power microscope would resolve this spot into countless individuals. It has been estimated that one microbe by division has produced in forty-eight hours, some trillions of its kind which, to the naked eye, appear as a mere spot or streak. These various kinds of bacteria that fall with the dust of the air may be round like marbles, when they belong to the group known as cocci, or rod shaped, when they are called bacilli, or spiral or curved when they are called spirilli.

The word microbe, or bacteria, carries no terror to the mind of anyone who knows something about them, for the useful ones far outnumber the injurious ones. Cheese depends on bacteria for its flavor, and fermentation depends on their presence, the bouquet of the different kinds of wine, being due to the kind of bacteria that falls into the juice of the grape. The bacteria of decomposition, everywhere present in the air, that attack meat, vegetables and fruits, are not harmful unless they are eaten, although the odor that comes from the breaking up of the particles may be unpleasant.

The pathogenic bacteria, or those harmful to health, that are carried by the air are very few, for most bacteria like plants, are very sensitive to the nature of the soil and of the climate they grow in. Exposure to sunlight for a short time will kill most of them, and when dried they die. A point much below boiling kills them, and in ice it is impossible for most bacteria to multiply: as may be seen in the case of the bacteria of decomposition, for bodies of guides lost in glaciers are sometimes found as perfect as in life after a score of years. Nevertheless it is a well known fact to sanitarians that there are houses and districts which by means of overcrowding of population and dampness and wretchedness of the inhabitants, become infected with certain diseases, and serve as veritable pest holes. There are also diseases which lie dormant part of a year and spring up at certain seasons, as smallpox in cold weather and cholera in summer; these facts together with the possibility of communicating disease by wearing an article of clothing or sleeping in a room long after it has been infected show that the bacteria must be able in spite of their sensitiveness to live a long time.

The secret of this power was discovered by Dr. Koch when he was a young man. He found that it is not the little living coccus or bacillus, or spirillum, that could withstand extremes in temperatures, but the spores that developed in them. For instance, he experimented on the bacteria of anthrax or malignant pustule which is fearfully contagious and which would break out year after year among men and animals in some districts. He found that in the small rods which are the germs of this disease, there would appear after a few days small oval spots which would finally break up into small spores.

These he inoculated into animals who died and were found to have millions of similar bacteria in their blood with numerous spores. This blood he found after drying was just as capable of producing the disease as at first on account of these spores. The only thing that destroyed them was red heat. But the spores of each of the bacteria have their own particular death degree, some can withstand boiling water for several hours, but succumb if they are alternately boiled and cooled; others can be frozen in ice all winter, but will develop and begin to grow when thawed out. Therefore it is necessary to know the favorable conditions of growth and the death limit of all the bacteria in order to know how to deal with those that cause disease.

The bacteria of disease get into the air only after they are dried for they never grow or develop except in moisture; but when anything which may have contained them, as the sputum of consumptives, the blood, or discharges from wounds has dried, they become splintered off and are swept into the air. The bacteria on patients' clothes, drying in the wind may be blown off attached to little particles of lint. In the case of sewage which is always swarming with bacteria, few of which are harmful, typhoid fever and possibly diphtheria being exceptions, the bacteria get into the air by the bursting of bubbles on the surface which sends a little watery spray into the air which, if it contains living germs of disease, may fall upon food and so get into the digestive system, or be breathed and come in contact with the mucous membrane of the throat and by these methods produce the diseases.

The method by which measles, scarlet fever, smallpox, and chickenpox, typhus and epidemic cerebrospinal fever is carried through the air is still unknown. The method by which the germ of consumption is carried through the air is however thoroughly understood; and the subject assumes vital interest when it is remembered that in the civilized countries of Europe, Asia and America, from one-seventh to one-fifth of the population die from the effects of this bacterium the Bacillus tuberculosis, and that in fully one-half of the cases, the seat of the disease is in the lungs and is caused by breathing the germs; while many of the other cases arise from the germ falling from the air upon the food. The main source of the contagium is from the sputum of human beings and from the excreta of consumptive animals, cows in particular. Were it not that the sun's rays and exposure to drying kill most of the bacteria their number would be simply appalling and there would be no avenue of escape from the disease. As it is the only way to prevent them from getting into the air is by exercising the most scrupulous cleanliness in cases of the disease.

In short, cleanliness is the surest preventive of all diseases. Many diseases caused by bacteria whether contagious or not, come from food, but the food may have been infected by the air. As, for instance, sterilized milk in which not a germ exists, if left standing open to the air for an hour will acquire enough bacteria from the dust that drops into it to start the sour fermentation which if continued in a child's stomach may produce cholera infantum.

The laws of health demand not only plenty of air so that each human being shall have sufficient oxygen, but that the surroundings should be clean so that the air shall not be contaminated.

A German judge has pithily said that "Crime bears an exact relation to the cubic space of a nation's dwellings". Whether or not sin can be claimed to be a dependent feature of poor ventilation; it is certain that since the reasons for the necessity of fresh air and the nature of bacteria have been understood, and proper sanitary measures have been enforced in schools, prisons, barracks, tenements and workrooms, there has been a decided improvement in the physical, mental and moral tone of the community, and an uncalculable of the human race.

64 West Fifty-sixth Street

News Items

Infantile Paralysis Research at Marquette University.—The Marquette University School of Medicine, Milwaukee, Wisconsin, has received $1500 from the National Foundation for Infantile Paralysis, Inc., to carry on research work in the fight against infantile paralysis. The purpose of the grant is to study the relationship of nutrition to the morphology and physiology of the neuromuscular apparatus in skeletal muscle.

Railway Surgeons Postpone Meeting.—The annual meeting of the American Association of Railway Surgeons which was to be held in Chicago, September 10th to 12th, has been canceled and all such future meetings have been postponed for the duration of the war.

Association for Advancement of Oral Diagnosis.—The ninth annual meeting of the Association for the Advancement of Oral Diagnosis will be held in Boston, November 12th to 13th, at the Forsyth Dental Infirmary. The subject for discussion at this meeting is "The Military Aspects of Oral Diagnosis."

American College of Surgeons Changes Date of Meeting.—The Clinical Congress of the American College of Surgeons which was scheduled to be held at the Stevens Hotel, Chicago, during October, will be held in Cleveland, November 17th to 20th with headquarters at the Cleveland Municipal Auditorium. The twenty-fifth annual Hospital Standardization Conference, sponsored by the College of Surgeons, will be held simultaneously with the congress.

Faculty Changes at Harvard.—The following promotions on the staff of Harvard Medical School, effective July 1st, have been announced: Dr. George Van S. Smith, assistant professor of gynecology, to W. H. Baker professor of gynecology; Dr. Francis R. Dieuaide, clinical professor of medicine; Edward W. Dempsey, Ph.D., assistant professor of anatomy; Dr. Robert N. Nye, assistant professor of bacteriology and immunology; Dr. Austin M. Brues, assistant professor of medicine; Dr. Robert E. Gross, assistant professor of surgery; Frank W. Maurer, Ph.D., assistant professor of physiology; Madeleine F. Warren, Ph.D., assistant professor of physiology; Wilfred W. Westerfeld, Ph.D., associate in biological chemistry; Dr. John H. Dingle, associate in medicine; Dr. Charles A. Janeway, associate in medicine; Dr. Nathan B. Talbot, associate in pediatrics; Leslie Silverman, associate in industrial hygiene; Dr. Joseph V. Meigs, clinical professor of gynecology.

Personal.—Dr. Ray Lyman Wilbur, president of Stanford University since 1916, will continue as head of the University through the academic year ending August 1943, because of the war emergency. It is announced that this is the third time since Dr. Wilbur reached the retirement age in 1940 that he has consented to continue to direct the university.

Dr. Louis Leiter, formerly associate professor of medicine at the University of Chicago School of Medicine, has been appointed chief of the medical division of Montefiore Hospital for Chronic Diseases, New York, succeeding Dr. Leopold Lichtwitz who has been promoted to the rank of consulting physician.

Dr. John L. Rice, who in July resigned as Health Commissioner of New York City, on account of ill health, has been appointed deputy health commissioner.

Dr. Stephen A. Cobb, of Sanford, Maine, was named president-elect of the Maine Medical Association at the annual meeting held in June, and Dr. Carl H. Stevens, of Belfast, was installed as president.

Dr. Carl W. Apfelbach, Rush professor of pathology, University of Illinois College of Medicine, has been appointed medical director of Presbyterian Hospital, Chicago.

Dr. Elliott Carr Cutler, Moseley professor of surgery, Harvard Medical School, has returned to active duty with the U. S. Army after an interval of twenty-three years.

Colonel Norman Kirk, M.C., until recently head of the surgical service of the Walter Reed Hospital, Washington, D. C., has been assigned to command the new Army hospital at Battle Creek, Mich.

Dr. E. Zeh Hawkes, of Newark, N. J., has received the third Edward J. Ill Award for his leadership in the development of medical activities in Newark. This award was established by the Academy of Medicine of Northern New Jersey in honor of the late Dr. Edward J. Ill.

Robert R. Sears, Ph.D., formerly research assistant at the Institute of Human Relations, Yale University, has been appointed head of the Iowa Child Welfare Research Station, Iowa City.

Dr. Catharine MacFarlane, of Philadelphia, professor of gynecology at the Woman's Medical College of Pennsylvania, has been made research professor of gynecology in recognition of her work in cancer research at the college.

Dr. Hugh C. Henry, of Richmond, Va., has been appointed commissioner of mental hygiene and hospitals, a newly created position in the state government reorganization act.

Dr. Francis R. Packard, formerly professor of otology of the Postgraduate School of the University of Pennsylvania, has been given the Newcomb Award of the American Laryngological Association.

Dr. M. Edward Davis and Dr. William J. Dieckmann, associate professors in the department of obstetrics and gynecology at the University of Chicago, have been promoted to professorships.

Dr. Meyer K. Amdur has resigned as chief of the reconstruction service, Veterans Administration Facility, Coatesville, Pa., to become assistant superintendent at the Longview State Hospital, Cincinnati, Ohio.

Faculty Changes at Cornell.—Faculty changes at Cornell University Medical College have been announced as follows: Dr. John M. McLean has been named clinical professor of ophthalmology, and Dr. Nelson W. Cornell, Dr. Guilford S. Dudley, and Dr. Arthur Palmer have been named associate professors of clinical surgery. Dr. Ade T. Milhorat has been named associate professor of medicine and Dr. Philip M. Stimson and Dr. May G. Wilson has been appointed associate professors of clinical pediatrics. Assistant professors are Dr. Edwin T. Hauser and Dr. Henry S. Dunning, clinical medicine; Dr. John H. Eckel, clinical surgery; Dr. George Burroughs Mider, pathology, and Dr. Charles O. Warren, anatomy.

Free Treatments at Mount Sinai Hospital.—In the eighty-ninth annual report issued by Mount Sinai Hospital, New York, it was stated that a total of 350,000 out of 483,853 patients had been admitted and treated free of charge at Mount Sinai Hospital in the ninety years it had been operating. In addition, the report stated, doctors at the hospital have given more than ten million consultations in the hospital without charge. The hospital, in its first year, treated 225 patients. In 1941 there were 17,222 patients treated in the wards, semiprivate rooms, and private rooms of the hospital. The clinic, one of the largest out-patient departments in any voluntary hospital in the country, treated 27,654 patients last year.

Nutrition Advisory Service.—An industrial nutrition advisory service has been organized under the direction of Dr. W. H. Sebrell, director, Division of Chemotherapy, U. S. Public Health Service, and M. L. Wilson, assistant administrator, Office of Defense Health and Welfare Services. This service will provide practical recommendations to both government owned plants and private industries to meet specific industrial nutrition problems which may affect production by increasing absences and accidents. Dr. Robert S. Goodhart, of New York City, who recently received his appointment in the U. S. Public Health Service, will direct the nutrition advisory service to industry. Assisting Dr. Sebrell and Dr. Goodhart will be Dr. Mark Graubard, well known biochemist, formerly on the staff of Columbia University and Clark University, who has studied food habits and customs of peoples in many parts of the world, and Ernestine Perry, formerly of Springfield, Mass. The object of this new service is to reduce the twenty-four million man hours lost monthly on the production front.

Faculty Changes at New York Medical College.—The following changes in the faculty of New York Medical College, Flower and Fifth Avenue Hospitals, have been announced: Dr. Milton J. Wilson named assistant to the dean; Laura Florence, Ph.D., professor and director of the department of bacteriology; Dr. Lindsley F. Cocheu, professor and director of the departments of public health and industrial medcine; Dr. Francis D. Speer, associate professor of pathology and director of clinical pathology laboratory; Earl W. Count, Ph.D., associate professor of anatomy; Dr. Remick C. Eckardt, associate professor of anatomy; gology; Dr. Margaret R. Reynolds, associate professor of pediatrics; Dr. L. Corsan Reid, associate professor of physiology and biochemistry; Malcolm W. Carr, D.D.S., assistant professor of oral surgery and acting head of the oral surgery section.

Book Reviews

Internal Medicine

Treatment in General Practice. By HARRY BECKMAN, M.D., professor of pharmacology, Marquette University School of Medicine, Milwaukee, Wisconsin. Fourth edition, thoroughly revised. Philadelphia and London: W. B. Saunders Company, 1942. Pp. 1015. Price $10.00.

This new edition brings up to date most of the therapeutic armamentarium of internal medicine. It is an editorial compilation of the literature on those branches of medicine that come within the immediate scope of the general practitioner. Special forms of therapy in medical and, especially, in the surgical fields are not included. After a consideration of infectious diseases, and parasitic infections, there follow chapters on allergy, deficiency, endocrine, digestive, respiratory, renal, blood, circulatory, nervous and skin disorders. There are special chapters on disturbances in menstruation, disorders caused by excessive heat, eclampsia, hyperemesis gravidarum, geriatrics, acute poisoning, burns and sulfonamide toxicity. Recent advances have brought to the fore a number of new maladies, the mechanism and management of which are given in summary form.

Infant Feeding

Infant Nutrition. A textbook of infant feeding for students and practitioners of medicine. By WILLIAMS MCKIM MARRIOTT, B.S., M.D., late professor of pediatrics, Washington University School of Medicine. Revised by P. J. JEANS, A.B., M.D., professor of pediatrics, College of Medicine, State University of Iowa. Third edition. St. Louis: C. V. Mosby Company, 1941. Pp. 475. Price $5.50.

The present edition has been condensed, displacing theoretical material with current present advances. The same pattern is maintained in Jeans' revision of Marriott's book. It is limited entirely to the nutritional aspects of infants. After preliminary consideration of growth, development and metabolism there are discussions of breast feeding, artificial feeding and different types of feeding for sick infants. Some of the more important nutritional disorders of infants such as malnutrition, dysentery, celiac syndrome, rickets, scurvy and tetany are given special chapters. The book is clearly written and well organized for the important field of infant nutrition.

Pathology

Essentials of Pathology. By LAWRENCE W. SMITH, M.D., professor of pathology, Temple University School of Medicine, and EDWIN S. GAULT, M.D., associate professor of pathology, Temple University School of Medicine. With a foreword by JAMES EWING, M.D., Memorial Hospital, New York. Second edition. New York and London: D. Appleton-Century Company, Inc., 1942. Pp. 904. Price $10.00.

Medical education has adapted itself to the rapid transition of medicine as a simple art to medicine as a complex science. Consequently, this new edition is limited to essentials of pathology that can be embodied in a student's course. More emphasis is placed on principles than upon the actual encyclopedic facts. The case history method of teaching, the oldest in education, is revised for teaching pathology. The field is viewed in terms of alteration in cell function as the basis of disease, just as medicine interprets signs and symptoms of disturbed function. They are merely methods of approach to the same problem, hence the case history method of presenting the essentials in pathology is the most logical for a well organized text. The first chapters include a full description of pathological principles and mechanisms with details of the gross and microscopic pictures. The remaining chapters are devoted to oncology and systemic pathology. The book is veritably a complete system of medicine with special stress on the pathological aspects. The purpose is commendable but the end result occasionally robs the student of valuable pathology. The terseness of the material and the correlation of clinical data make this a unique contribution to medicine. Somehow such an approach makes pathology more dynamic and, hence, more useful in the diagnosis and management of disease.

Allergy

Allergy in Clinical Practice. By staff members of the Cleveland Clinic, under the direction of RUSSELL L. HADEN, M.D., F.A.C.P., chief of the Medical Division. Edited by J. WARRICK THOMAS, M.D., F.A.C.P., chief of the Section on Allergy. Ninety-two illustrations including fourteen subjects in color. Philadelphia, Montreal, and London: J. B. Lippincott Company, 1941. Pp. 354. Price $5.00.

Hypersensitivity is an important factor in the causation of disease in man. This book, integrating all aspects of the subject, will be welcomed by the general practitioner. About ten percent of the population shows significant symptoms of allergy and about sixty percent may have some manifestation of the allergenic state. Specialists in each field evaluate the rôle of allergy in various disease pictures, a procedure more desirable than for the allergist to interpret the rôle of allergy in various specialties. Case histories are illustrated and every phase of allergy is observed and differentiated, emphasizing its place in picturing various disease aspects applicable to a particular problem. Each allergic disorder is considered in great detail in terms of incidence, classification, clinical history, physical examination, individual treatment and final summary. It is well written, clearly illustrated and always practical.

The Larynx

Diseases and Injuries of the Larynx. A textbook for students and practitioners. By CHEVALIER JACKSON, M.D., Sc.D., LL.D., F.A.C.S., honorary professor of bronchoesophagology, Temple University, and CHEVALIER L. JACKSON, A.B., M.D., M.Sc. (Med.), F.A.C.S., professor of bronchoesophagology, Temple University, Philadelphia. With over two hundred illustrations, including eleven plates in color. New York: Macmillan Company, 1492. Pp. 633. Price $8.00.

The name, Jackson, has so long been intimately associated with American laryngology that any book bearing it must receive more than passing notice. There is such a wealth of material in this second edition of the original 1937 work, that it is difficult to pick out the items of greatest interest. The human larynx has nine "physiological functions", namely, respiratory, circulatory, fixative, protective, deglutitory, tussive, expectorative, phonatory, and emotional. Each of these is properly described and illustrated in the text. No laryngeal examination is complete unless one uses a mirror, introduces a direct tube, palpates the neck and larynx, and makes a roentgen ray study. To the average physician this seems like a large order, but it is the result of experience; no doubt, too, the result of errors made by not doing it. In any case, say the Jacksons, "no laryngeal examination is complete unless one sees the anterior commissure and the ventricle." No doubt

these are set down because they are the regions most difficult to view. The difficulties of a thorough examination are apparent to anyone who has practiced with the laryngeal mirror. It seems as though every element combines with every other to defeat the observer—choking, gagging, swallowing, an obstreperous tongue, a "nervous" patient, all try to down the laryngologist.

Of especial interest and importance are the chapters dealing with precancerous conditions, the neuroses and neuronoses (functional and organic), the larynx in general diseases, the effect of drugs and trauma, "laryngitis" from whatever cause, and its exact diagnosis and treatment, and war injuries. These latter are so often fatal that the laryngologist is likely to be too late. The soldier bleeds to death or drowns in his own inhaled blood. This new volume from the Jacksons keeps up their well-recognized high standard in laryngology.

Medical Milestones

Medical Anniversaries of 1942 and 1943

The year 1942 is peculiarly lacking in medical anniversaries. The earliest anniversary date which records show to have any real medical significance was the year 542 A.D. which was marked by the founding in France of the "nosocomia", a kind of primitive charitable hospital under the supervision of the Church in which the clergy and nuns extended care to the ailing poor. No other anniversary date of medical importance is recorded until 1642, when Jacob Bontius published the earliest known description of the disease beriberi. Fifty years later, in 1692, Ammann succeeded in teaching deaf-mutes to communicate with one another and later with persons who heard and spoke normally.

When we come to the year 1742, however, several important events in the history of medicine spring into the limelight. It was at this time that Celsius made known his invention of the one hundred degree thermometer, and Linnaeus first described the condition now known as aphasia. This year was marked also by the peak of the influenza pandemic then ravaging Europe. In this country a noteworthy event took place—the birth of Samuel Bard, famous physician, writer on medical subjects, teacher and practitioner, and one of George Washington's personal physicians. Fifty years later Galvani published his well known *Essay on Animal Electricity,* Fodéré his *Treatise on Goitre and Cretinism,* and Sprengel his great history of medicine. This year also was marked in this country by two important events in the history of our medical institutions and organizations—the founding of the Connecticut Medical Society, and the changing of the name of New York City's famous King's College to Columbia College, with Dr. Bard as dean of the faculty and professor of medicine.

Entering the domain of modern medicine, in the year 1842 Long performed his epoch-making operation on a patient with ether anesthesia used for the first time. During this year also Dieffenbach published his classic treatise on strabismus. Half a century later the well known Wistar Institute of Anatomy and Biology was incorporated, and an extremely important surgical event took place—Halsted's ligation of the subclavian artery in the first portion.

The search for anniversary years in 1943 is more fruitful. We find that in the year 543 A.D. the famous "plague of Justinian" ravaged the Roman Empire. Many medical historians have studied the records of this epidemic, and have arrived at many different conclusions as to its origin and nature, all too numerous to quote here. In 1243 the University of Salamanca was founded by Ferdinand III of Castile who permitted "instruction in healing" to be included in the curriculum. Two hundred and fifty years later, in 1493, Paracelsus was born.

In 1543, the year made famous by Copernicus's first scientifically true description of our solar system, the science of medicine was enriched by the publication of Vesalius's *Fabrica,* an event which has been called the establishment of the foundation of modern anatomy. During this year also the English Apothecaries were legalized by an Act of Parliament. One hundred years later Acoluthus of Breslau performed his famous operation of resecting the lower jaw, and two hundred years later Stephen Hales published the earliest treatise on ventilation from a health and therapeutic point of view; in Prussia Frederick the Great established a law separating the hospitals from the socalled "flying ambulances." In 1793 Matthew Baillie's *Morbid Anatomy* was published, Benjamin Bell differentiated gonorrhea from syphilis, and Matthew Carey wrote his classic description of the yellow fever epidemic in Philadelphia.

The year 1943 will mark the centenary of Dr. Oliver Wendell Holmes's famous address pointing out the contagious character of puerperal fever, of Küchler's introduction into medical practice of "test types", and of the invention and first use of the uterine sound by a group of French physicians. Also, during this year the Société de Chirurgie was founded in Paris.

In 1893 Roentgen made his accidental but epoch-making discovery of the x ray, Smith and Kilbourne demonstrated the transmission of parasitic diseases by arthropoda, Gilbert isolated paracolon and paratyphoid bacilli, the Finsen light was introduced into medical practice, and the International Cholera Conference was held in Dresden, a gathering that resulted in the formulating and establishing of a number of methods and agencies for international cholera control, some of which are still in operation.

It is not too early to predict that the years 1942 and 1943 will be notable ones in the development of the sulfonamides, of military medicine and surgery, aviation and health, and other forms of therapeutic, medical and surgical practice.

A famous doctor once said that the important results of wars are not new national boundaries, subjection of peoples, victories and conquests; the most important results of all wars are new discoveries, especially along the lines of hygiene, medicine and surgery, that add to the health, comfort and happiness of peoples, and that make for the preservation and maintenance of the peaceful way of life, rather than the degradation, the horror and the irreparable devastation of war. Let us dare to hope that our sacrificial years of war may at least create anniversary years to be celebrated in the future as steps in the progress of science toward peace.

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SEPTEMBER 1942

Medicolegal Notes

Negligence in Permitting Broken Needle to Remain in Wound Must Be Proved

In a malpractice action the negligence alleged in the petition was permitting two surgical needles to remain in the wound after a very difficult operation, repairing a severed artery, one of the largest in the foot of a child cut by a broken glass jar, causing the foot to be infected. This being a specific act of negligence, the Kentucky Court of Appeals followed its rule that only this specific act could be considered in deciding on defendant's liability.

The plaintiff invoked the doctrine of *res ipsa loquitur*. It was held that the doctrine did not apply to such cases as this. The Kentucky Court of Appeals quoted the rule in Kentucky, as stated in Stacy vs. Williams, 253 Ky. 353, 69 S. W. 2d 704, to be that "the burden of proof is upon the patient to prove the negligence of the physician or surgeon, and that such negligence was the proximate cause of his injury and damage. The presence of infection following an operation is neither prima facie evidence of, nor, per se, negligence."

The plaintiff here merely proved that the defendant permitted the needles to remain in the wound, but did not prove by any competent evidence that this was negligently done or that any damage or injury resulted from such action. The evidence did not show that plaintiff suffered any additional pain or suffering apart from the operation because of the broken needles being left in the wound. Proof on such an issue would have to be established by expert testimony. All the medical evidence in the case was to the effect that it would have been bad surgical practice to probe for the needles on account of danger of spreading infection. Judgment for the defendant was affirmed. Steinwetz vs. Humphrey, 160 S. W. 2d 6.

Plaintiff Patient Should Not Be Asked to Waive Statutory Privilege

The plaintiff in a wife's divorce suit testified on cross-examination that she did not have a venereal disease. She was asked whether she would permit her physician to take the witness stand and testify as to her condition and she answered, yes. She was also asked whether she was willing to waive her statutory privilege in so letting the doctor testify and answered, yes. Before the physician was called as a witness, however, she filed a motion to permit her to withdraw her waiver of privilege made on cross-examination. This motion was granted by the trial court. On appeal it was held that under the circumstance the plaintiff had the right to withdraw her waiver, and that the trial court's ruling could also be sustained on the ground that plaintiff did not have an understanding of her legal right, did not understand the meaning of the term "waiver" and did not have an opportunity to advise with her counsel.

It is error, the court held, to ask a patient on cross-examination if she will waive her statutory privilege. "It is a legal right, and a party should no more be required to state under oath that he did not want to surrender it than any other legal right he possessed. We think a fair trial requires that such a matter should not even be referred to; that a jury should not be impressed with a belief that there is even reluctance in giving such assent." Donovan vs. Donovan, 231 Iowa 14, 300 N. W. 656.

Breaking Needle Against Bone May Raise Presumption of Negligence

When a doctor, in the process of administering a spinal anesthetic, forces the needle into the bony structure of the spine, causing the needle to break, and injury results therefrom, the breaking of the needle, coupled with its location outside of the channel of soft tissues and against the bone of the spine, gives rise to a prima facie case of negligence sufficient to call upon the anesthetist for the explanation. Wiley vs. Wharton, Ohio Court of Appeals, 41 N. E. 2d 255.

Operating Surgeon Not Responsible for Anesthetist's Negligence

A surgeon employed to perform an operation upon a patient is not liable for the negligent acts of a fellow surgeon, engaged by him with the implied consent of the patient to administer the necessary anesthetic, when it appears that there was no negligence in the employment, and no participation, active or positive, in the negligent conduct of the other surgeon. Wiley vs. Wharton, Ohio Court of Appeals, 41 N. E. 2d 255.